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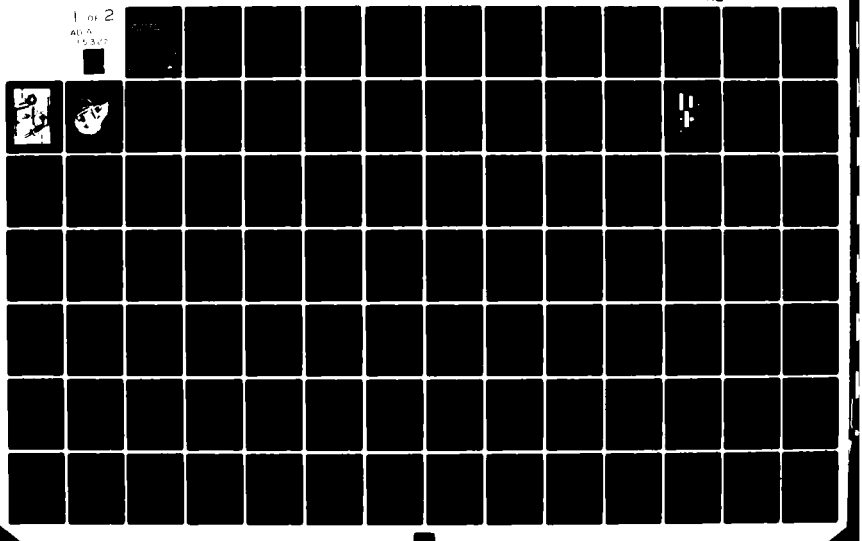

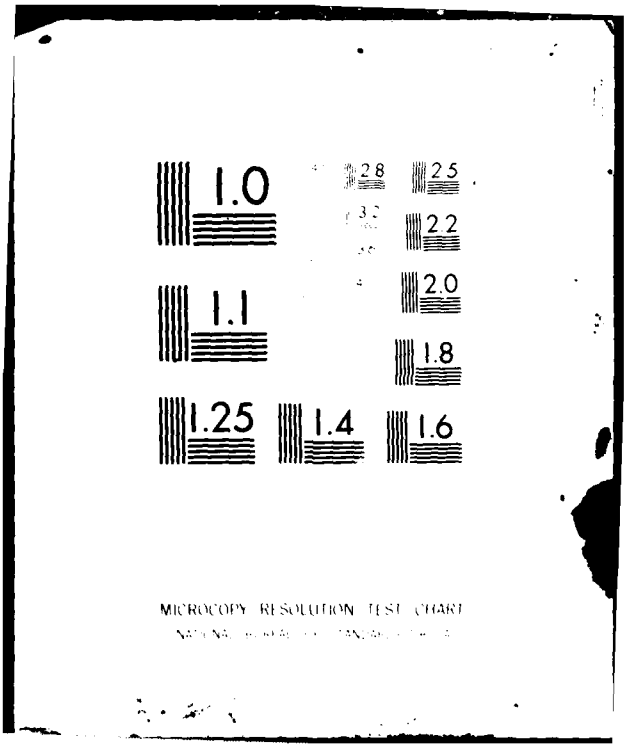
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Report SAM-TR-81-35

AUTOMATED CALCULATION OF PROTECTION FACTORS FOR THE DI-2-ETHYLHEXYL PHTHALATE RESPIRATOR QUANTITATIVE FIT TEST INSTRUMENT

Edward S. Kolesar, Jr., Captain, USAF

December 1981

Final Report for Period 1 March 1981 - 30 June 1981

USAF SCHOOL OF AEROSPACE MEDICINE
Aerospace Medical Division (AFSC)
Brooks Air Force Base, Texas 78235

NOTICES

This final report was submitted by personnel of the Crew Environments Branch, Crew Technology Division, USAF School of Aerospace Medicine, Aerospace Medical Division, AFSC, Brooks Air Force Base, Texas, under job order 2729-00-20.

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This report has been reviewed by the Office of Public Affairs (PA) and is releasable to the National Technical Information Service (NTIS). At NTIS, it will be available to the general public, including foreign nations.

This technical report has been reviewed and is approved for publication.

Edward S. Kolesar, Jr.

EDWARD S. KOLESAR, JR., Captain, USAF
Project Scientist

RICHARD L. MILLER, Ph.D.
Supervisor

ROY L. DEHART
Colonel, USAF, MC
Commander

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Scattered-light photometer
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20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

An automated procedure for calculating a respirator protection factor is presented in this report. This procedure not only reduces the di-2-ethylhexyl phthalate leak test data, but also calculates a protection factor by using a voltage-to-frequency converter circuit to do time-averaged integration. A computer program has been developed to calculate individual exercise, averaged, and time-weighted averaged protection factors.

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PREFACE

The author is grateful to those people at the USAF School of Aerospace Medicine, Brooks AFB, Tex., who contributed suggestions and criticisms during the development of this report. Special thanks are due to Dr. Richard L. Miller, Mr. Clarence F. Theis, and Staff Sergeant Colette M. de la Barre of the Crew Environments Branch.

The author also expresses particular appreciation to Mr. Daniel Sears, Engineering and Maintenance Services Branch, for fabricating the electronic integrator and buffer power amplifier.

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AUTOMATED CALCULATION OF PROTECTION FACTORS FOR THE DI-2-ETHYLHEXYL PHTHALATE RESPIRATOR QUANTITATIVE FIT TEST INSTRUMENT

INTRODUCTION

The purpose of this report is to present an automated procedure for calculating a respirator's protection factor (PF), afforded to the respiratory tract and eyes, against chemical warfare (CW) agents in particulate, aerosol, or vapor form. The Los Alamos Scientific Laboratory (LASL) is credited with developing the basic di-2-ethylhexyl phthalate (DEHP) respirator quantitative fit test (RQFT) method [1, 2]. Two United States manufacturers market a commercial version of the LASL DEHP RQFT instrument [3, 4]:

1. Air Techniques Incorporated
   1717 Whitehead Road
   Baltimore, Maryland 21207

   Telephone No.: (301) 944-6037

   (Mr. Samuel B. Steinberg, President)

2. Dynatech Frontier Corporation
   P.O. Box 30041
   Albuquerque, New Mexico 87110

   Telephone No.: (505) 226-7932

   (Dr. Charles L. Wright, Jr., President)

The United States Air Force School of Aerospace Medicine (USAFSAM) has several years of laboratory experience with RQFT research and development, and currently operates a sodium chloride (NaCl) and DEHP instrument [5, 6].

Our experience with RQFT instrumentation has shown one area to be of particular concern; namely, the method of reducing the collected data (respirator penetration concentration for a particular exercise protocol) and calculating a protection factor. Several interested organizations have developed and reported the following data reduction schemes for respirator quantitative fit testing [1, 2, 5-36]:

a. selection of the overall maximum output peak

b. arithmetic average of the maximum output peaks

c. arithmetic average of the maximum output peaks and minimum valleys (midpoint)

EDITOR'S NOTE: Available, on pp. 128 - 130, is a selective list (plus definitions) of the "Abbreviations, Acronyms, and Symbols" used throughout this volume.

d. visual estimation of the midpoint between the maximum output peaks and minimum valleys

e. time-averaged or integrated value.

This report develops an automated procedure to reduce the DEHP respirator leak test data and calculate a composite protection factor. A similar procedure has been adapted to the USAFSAM NaCl RQFT instrument [37]. An overview of the DEHP RQFT instrument is followed by: a discussion of conventional PF calculations; the use of a voltage-to-frequency (V/F) converter circuit to do time-averaged integration; and, finally, a computer program to calculate PFs.

DEHP RESPIRATOR QUANTITATIVE FIT TEST INSTRUMENT

The Dynatech Frontier Corporation's DEHP RQFT Instrument (Model FE259H) and Test Booth (Model FE222) have been adapted and modified by USAFSAM to measure the PF in the respiratory and eye compartments of aircrew and groundcrew chemical defense respirators [4]. This instrument generates a polydispersed liquid aerosol of di-2-ethylhexyl phthalate as the challenge atmosphere. The concentration of the challenge atmosphere in a respirator is quantified using a five-decade, linear-forward-light-scattering photometer; and the result is displayed on a strip-chart recorder. This technique allows protection factors as high as 10^6 to be calculated.

Instrument Description

Illustrated in Figure 1 are the primary components used in the USAFSAM modified version of the Dynatech Frontier Corporation's (Model FE259H) DEHP RQFT instrument [4]. The two fundamental systems constituting the DEHP RQFT instrument are: the aerosol generator, and light-scattering photometer.

Generation of the DEHP Challenge Aerosol Test Booth Atmosphere

The aerosol generating system consists of a source of laboratory compressed air, pressure regulator and gauge, aerosol impactor, generator, reservoir, mixing chamber, and dilution air blower (Fig. 1). The DEHP challenge aerosol test booth atmosphere is generated by atomizing the liquid DEHP from the reservoir of the aerosol generator.

The aerosol generator is supplied with a source of filtered and dried compressed laboratory air that is regulated to be in the range from 2-6 psig. The aerosol generator is a Naval Research Laboratory (NRL) Model III design [38]. When the laboratory compressed air enters the aerosol generator, a coarse DEHP aerosol is produced by high-velocity air jets that shear off droplets of the liquid DEHP. This coarse aerosol enters the impactor. The round jet impactor design is used to produce a DEHP aerosol with a mass median aerodynamic diameter (MMAD) particle size that ranges from 0.5 to 0.6 μm [4, 39]. The concentration of the impactor's refined DEHP aerosol is controlled in the mixing chamber with a regulated air supply provided by the dilution air blower. The result of the generation, impaction, mixing, and dilution processes is a DEHP test booth aerosol challenge atmosphere whose particle size and concentration are, respectively, 0.5 - 0.6 μm and 25 mg/m^3 ± 5 mg/m^3.

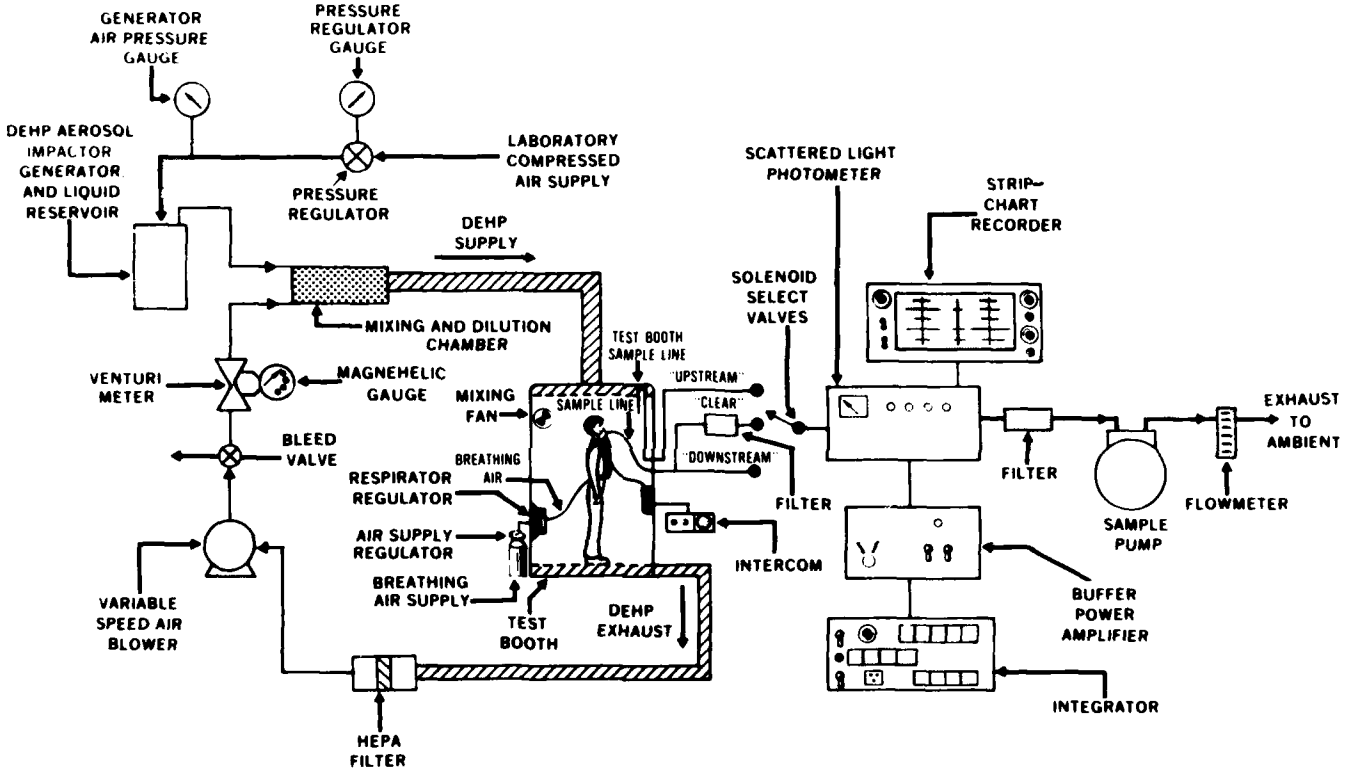

Figure 1. USAFSAM di-2-ethylhexyl phthalate respirator quantitative fit test instrument.

Measurement of DEHP Respirator Leakage

When evaluating the performance of a full-face chemical defense respirator, a primary concern is the penetration of the DEHP challenge atmosphere into the visual compartment. To make this measurement, an aluminum tube, approximately 1 in. (2.54 cm) long and 0.25 in. (0.635 cm) i.d., is fitted and sealed to the respirator's visor so that the distance from the cornea to the open end of the aluminum sampling tube (interior to the respirator's visor) is not greater than 0.8 in. (2 cm) [40]. Shown in Figure 2 is the aluminum sampling tube developed and used at USAFSAM; and, in Figure 3, an MBU-13/P aircrew CW respirator fitted with the sampling tube.

The concentration of the DEHP challenge atmosphere that has leaked into the visual compartment of the respirator is determined by continuously sampling gas from this site, and analyzing this gas with the linear-forward-light-scattering photometer. Sampling is accomplished by attaching one end of a short length of Tygon tubing to the open end of the aluminum sampling tube (exterior to the respirator's visor), and then passing the opposite end of the plastic tubing through a sealed port in the test booth (Fig. 1). A small capacity sampling pump is connected to the open end of the Tygon tubing to draw a gas sample from the respirator's visual compartment (constant 3-liter/min flow). The 3-liter/min sampling rate was selected to minimize negative pressure within the respirator's visual compartment; i.e., a greater sampling rate would tend to exaggerate the penetration measurement [4, 20].

Scattered-Light Photometer Detector

A five-decade, linear-forward-light-scattering photometer is used to analyze the DEHP aerosol sampled from the interior of the respirator. The photometer measures aerosol concentration by detecting the intensity of light scattered by the aerosol particles that are drawn through the light-scattering chamber of the photometer. The scattered-light intensity is converted to an electrical current which is electronically processed and displayed on a calibrated meter, as well as on a linear strip-chart recorder [4, 20]. A functional diagram of a light-scattering photometer is shown in Figure 4 [4, 20, 41, 42].

To develop a complete understanding of the proposed method to automate the calculation of protection factors, a review of the scattered-light photometer's signal generating process is presented next.

The incident light intensity (I_i), generated by a high-intensity filament lamp, is focused into the light-scattering chamber (Fig. 4). When a sample of air containing DEHP aerosol is introduced into the light-scattering chamber, a fixed amount of the incident light intensity (I_i) is absorbed (I_a) in direct proportion to the concentration of the DEHP aerosol. Thus, the scattered-light intensity (I_s) can be expressed as:

$$I_s = I_i - I_a \qquad (1)$$

The scattered-light intensity (I_s) is focused on a photomultiplier tube (PMT) which converts the light into a corresponding electrical current. The relative magnitude of the electrical current produced by the PMT is a function of the high-voltage power supply (Fig. 4). Thus, the sensitivity of the PMT, for a given DEHP aerosol sample concentration, can be established by varying the magnitude of the high-voltage power supply. A current-to-voltage operational amplifier circuit is used to produce a voltage signal compatible with the strip-chart recorder. The current-to-voltage conversion process is determined by the value of the feedback resistance (R) (Fig. 4). Thus, selection of R determines the range and magnitude of the voltage signal that can be displayed on the strip-chart recorder. One of the important elements of the light-scattering photometer is the stray light circuit. A component of the scattered light (I_s) is due to undesirable reflections, imperfect optics, contamination of the system, and the PMT's dark current response. Thus, the light incident on the PMT is composed of a component due to scattering by the sampled DEHP aerosol, and a stray or undesirable component. To assure that the strip-chart recorder only displays the voltage signal that corresponds to the DEHP aerosol concentration, it is necessary to compensate for the stray light component. The compensation process is implemented by purging the light-scattering chamber of DEHP aerosol with clean ambient air via a high-efficiency filter in the sampling system (Fig. 1). The stray light component is eliminated, by an operator adjustment of the instrument's stray light circuit control, to produce a zero reading on the instrument's front panel meter. The effect of the stray light compensating adjustment is to produce an opposite current signal (i_{sl}) which, when added to the PMT's current signal (i_{PMT}), results in a net current signal of zero magnitude. Finally, the current-to-voltage operational amplifier yields a voltage signal of zero magnitude for a zero magnitude input current signal.

Calibration Procedure

The calibration procedure used for the DEHP RQFT instrument is developed and discussed in a technical note included as Appendix A.

CONVENTIONAL PROTECTION FACTOR CALCULATIONS

A general discussion of a protection factor (PF) is presented here, along with a description of the manual calculation method. With this information, the reader can evaluate the respective advantages and disadvantages of the manual and automated methods of calculating PF's.

Protection Factor

A respiratory protection factor is defined as the ratio of the ambient challenge atmosphere concentration external to the respiratory protective device to that of the sampled leakage concentration drawn from the interior of the device [5, 7, 9-14, 20, 25, 27, 30, 34-37].

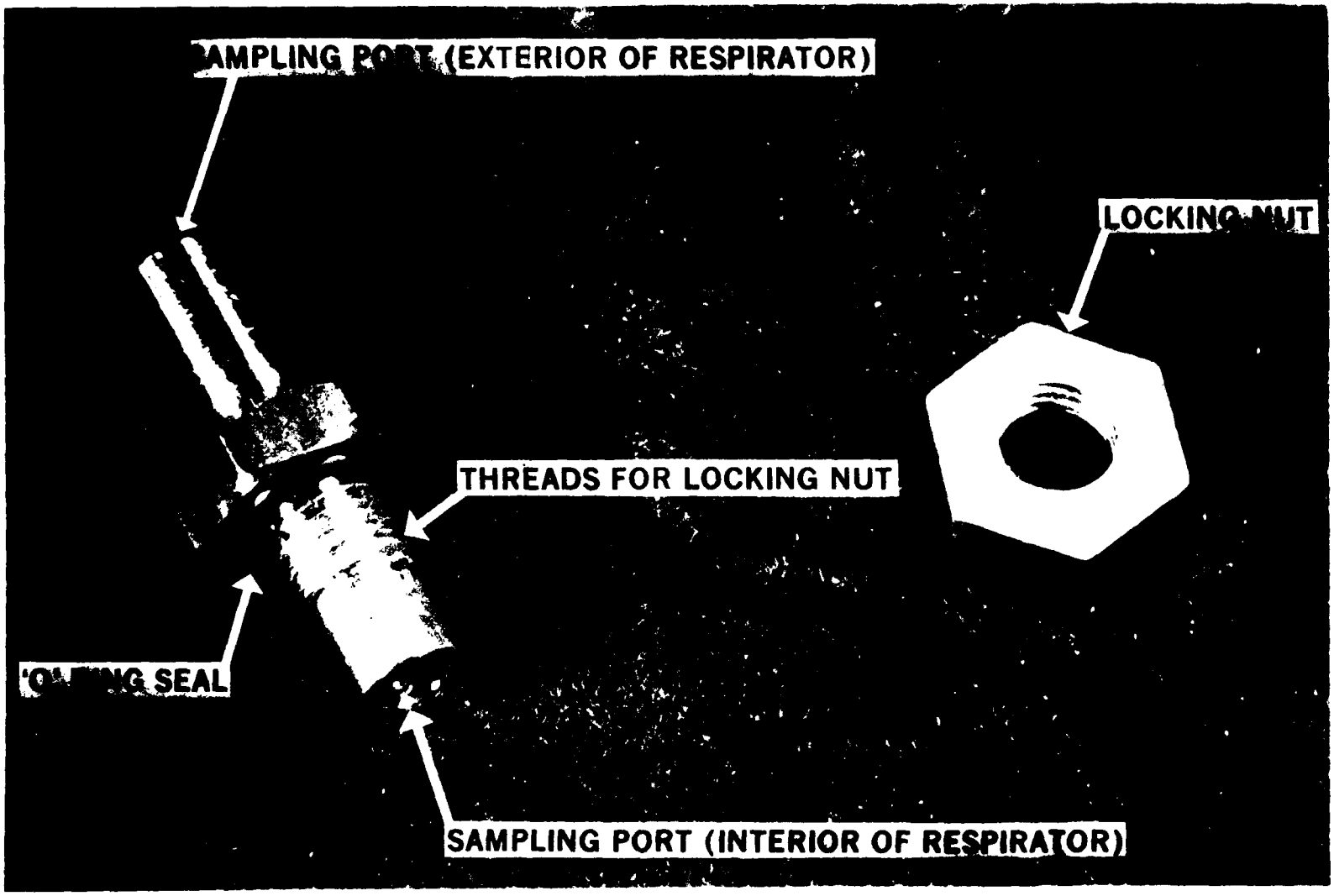

Figure 1. [illegible] sampling tube for the MSA-13/P respirator.

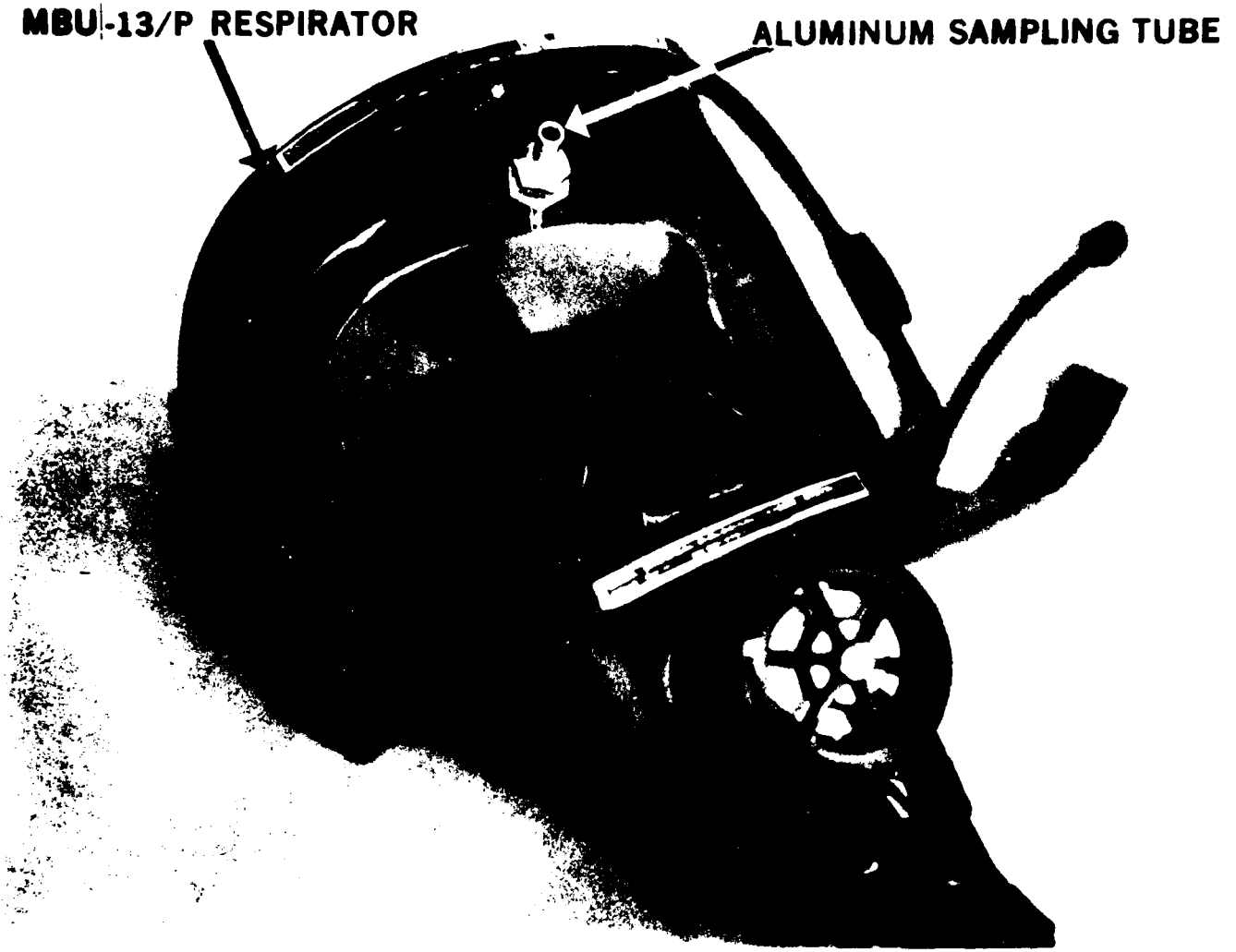

Figure 2. Air-raw MBU-13/P respirator with aluminum sampling tube.

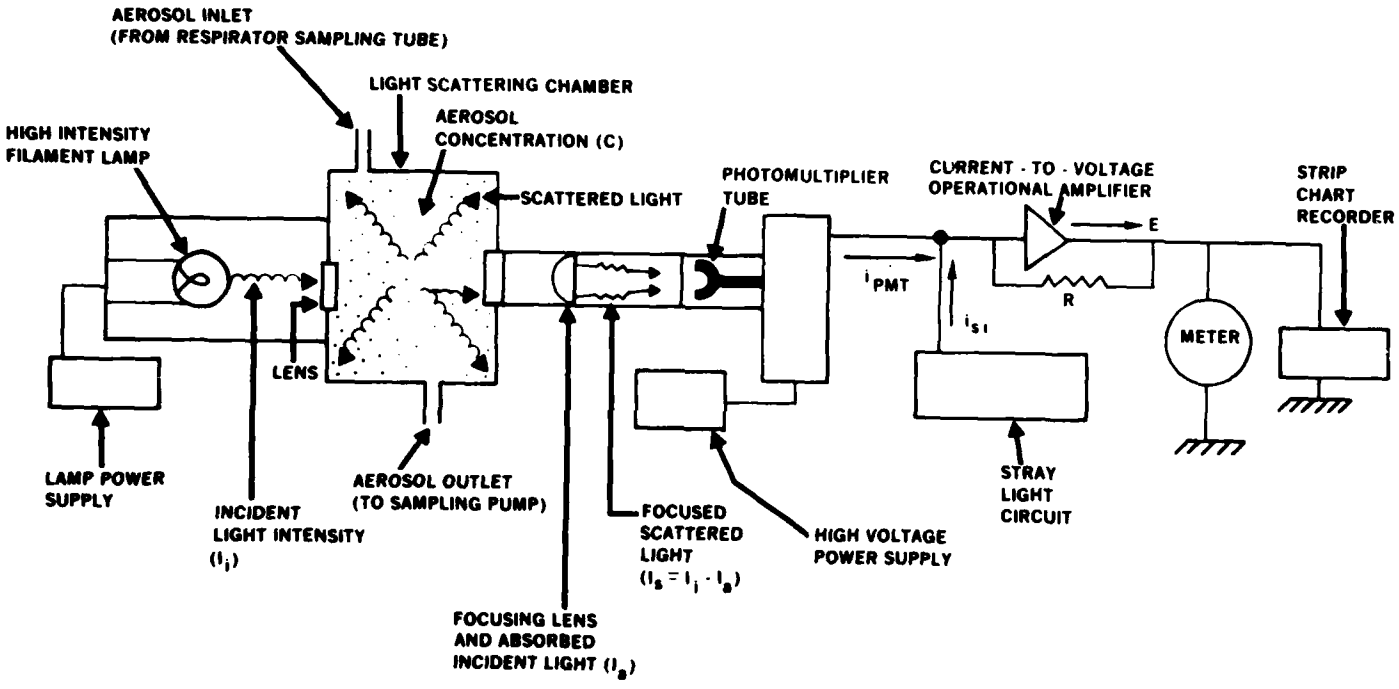

Figure 4. A light-scattering photometer (functional diagram).

Formally, this relationship can be expressed as:

$$PF = \frac{C_a}{C_s} \qquad (2)$$

where

PF = protection factor

C_a = ambient challenge atmosphere concentration

C_s = sampled leakage concentration.

Note that a PF is a dimensionless quantity. In the ratio, the units of concentration in the numerator and denominator cancel (assuming that C_a and C_s were measured and appropriately converted to a consistent set of concentration units; e.g., part per million, micrograms per liter, percent, etc.).

Also important in respirator quantitative fit testing is the calculation of an average protection factor ($\overline{PF}$). This calculation becomes important when the subject being evaluated performs a series of breathing and head movement exercises, each of which is designed to stress the face-to-facepiece seal. In mathematical terms:

$$\overline{PF} = \frac{\sum_{i=1}^{n} PF_i}{n} \qquad (3)$$

where

$\overline{PF}$ = average protection factor for n exercises

i = the i^{th} exercise, $i = 1, 2, 3, \ldots, n$

PF = protection factor associated with a particular exercise.

Similarly, an average weighted protection factor can be calculated when greater or lesser degrees of relative importance are assigned to individual exercise PF's. The most common example is that in which each exercise in an exercise protocol is performed for a different length of time; in this case, time would become the weighting factor. For completeness, a mathematical expression for an average weighted PF is:

$$\overline{PF}_w = \frac{\sum_{i=1}^{n} w_i PF_i}{\sum_{i=1}^{n} w_i} \qquad (4)$$

where

$\overline{PF}_w$ = weighted average protection factor for n exercises

i = the i^{th} exercise, i = 1, 2, 3, ..., n

w_i = weighting factor for the i^{th} exercise

PF = protection factor associated with a particular exercise.

Manual Method of Calculating a Protection Factor

The DEHP RQFT instrument, as well as most of the similar systems, does not display, record, or calculate PF's. The instrument does, however, record and display the relative penetration (leakage) of the challenge atmosphere into a respirator's facepiece. The calculation of PF's for the DEHP RQFT instrument can be explained through an example. Shown in Figure 5 is a typical quantitative fit test strip-chart recording that includes the preliminary calibration and penetration information for a set of six exercises:

a. normal breathing (NB)

b. deep breathing (DB)

c. talking (T)

d. turning head side-to-side with deep breathing (TH)

e. moving head up-and-down with deep breathing (UD)

f. facial grimacing (FG).

The analysis of Figure 5 begins at the bottom of the strip-chart recording. The first section of information uniquely identifies the particular subject and type of respirator.

The next section contains the instrument calibration data (a steady-state response for upstream sampling of the ambient DEHP challenge aerosol concentration in the test booth with the sampling range switch in the 100.0 percent

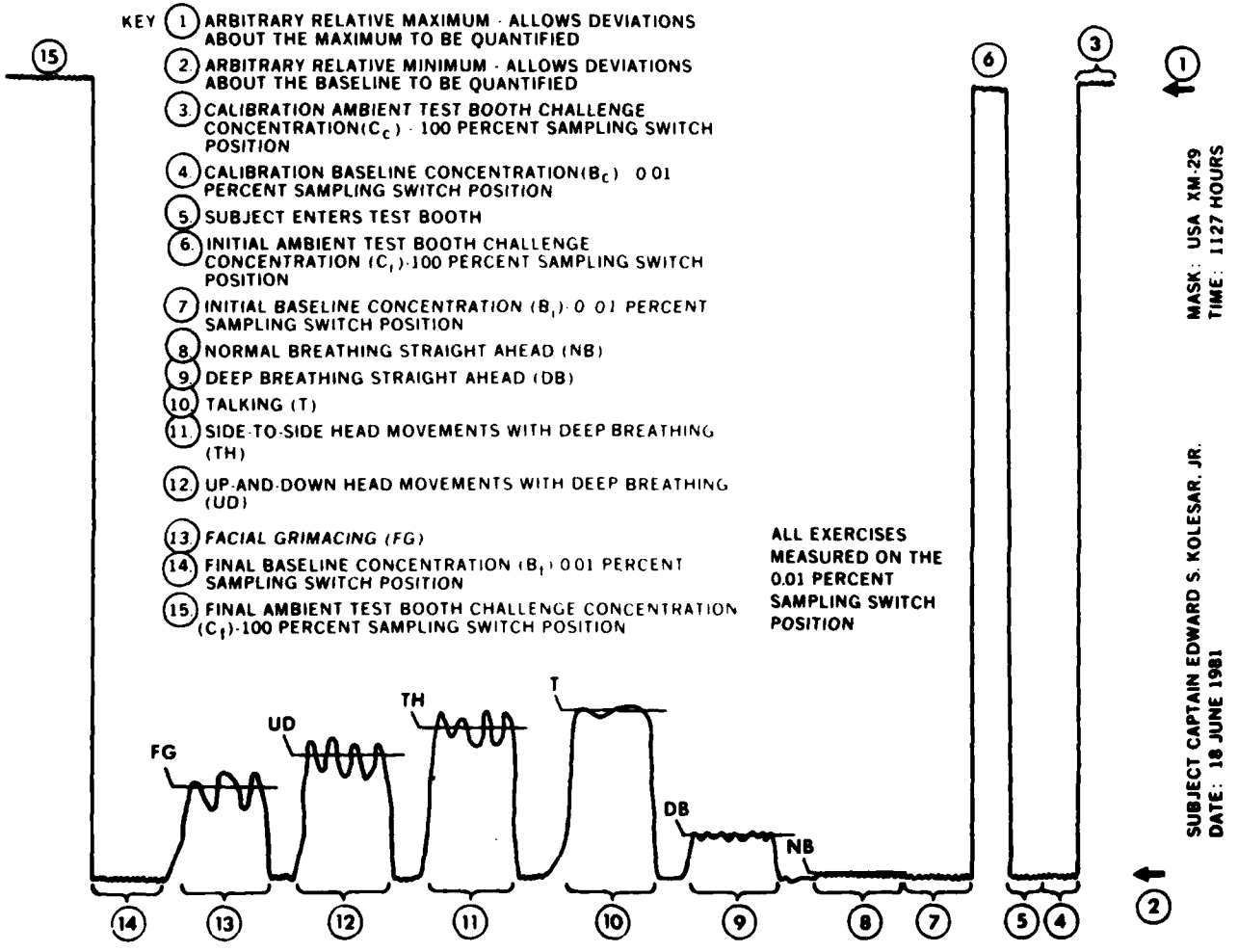

Figure 5. Strip-chart recording of a di-2-ethylhexyl phthalate respirator quantitative fit test.

position; a steady-state baseline response for sampling in the clear mode with the sampling range switch in the 0.01 percent position). The subject wearing a test respirator enters the test booth and breathes normally for about 5 minutes to establish a baseline in the challenge atmosphere. The subject then performs the six exercises in sequence, each for a predetermined time period. After the exercises are completed, and before the subject exits the test booth, a final check is made on the baseline (clear sampling mode) and ambient challenge (upstream sampling mode) concentration.

The cyclic nature of the recorder's trace during the exercises is a direct function of the subject's breathing cycle. Figure 5, for instance, reveals that the slight negative pressure created in the facepiece during inhalation increases the penetration of the challenge atmosphere. Exhalation, on the other hand, creates a slightly positive pressure, and acts to reduce the penetration of the challenge atmosphere. Because samples are drawn from the visual cavity of chemical defense respirators, absorption of the DEHP aerosol by the lungs is negligible. Therefore, respirator performance is based on the average of the penetration peaks and valleys for each of the exercises. Finally, the overall respirator performance is based on the arithmetic or time-weighted average of the exercise PF's.

Manual Strip-Chart Recorder Data Reduction and Analysis

Manual strip-chart recorder data reduction and analysis can be accomplished with a straight edge, pencil, and calculator. The analysis begins by drawing a series of dashed lines through the average of the strip-chart recording peaks and valleys associated with the individual calibration and exercise leak test measurements. The average of the peaks and valleys (location of their midpoint) is generally deduced visually. Table 1 is a summary of the "visual averages" identified for the strip-chart recording shown in Figure 5.

From the discussion in the previous section, an average PF for a particular exercise can be expressed as:

$$PF = \frac{\text{Average Corrected Test Booth Ambient Challenge Concentration (as a Percent)}}{\text{Average Corrected Respirator Sampled Leakage (as a Percent)}} \qquad (5)$$

The average corrected test booth ambient challenge concentration (as a percent) is given by:

$$C_{cor} = \left[\frac{(C_i + C_f)(K_{cc})}{2} - \frac{(B_i + B_f)(K_{bc})}{2} \right] \qquad (6)$$

where

C_{cor} = average corrected test booth ambient challenge concentration (as a percent)

C_i = initial ambient test booth challenge concentration

C_f = final ambient test booth challenge concentration

K_{cc} = instrument's sampling range switch position (typically 100.0 percent)

B_i = initial baseline concentration

B_f = final baseline concentration

K_{bc} = instrument's sampling range switch position (typically 10.0-0.01 percent).

TABLE 1. QUANTITATIVE FIT TEST STRIP-CHART RECORD

Parameter	Average strip-chart average value for a 0-100 scale	Sampling range switch position as a percent
Calibration ambient test booth challenge concentration (C_c)	95.0	100.0
Calibration baseline concentration (B_c)	5.2	0.01
Initial ambient test booth challenge concentration (C_i)	94.25	100.0
Initial baseline concentration (B_i)	5.2	0.01
Normal breathing (RE_{NB})	5.5	0.01
Deep breathing (RE_{DB})	1.0	0.01
Turning head side-to-side with deep breathing (RE_{TH})	2.4	0.01
Moving head up-and-down with deep breathing (RE_{UD})	2.2	0.01
Talking (RE_T)	1.9	0.01
Facial grimacing (RE_{FG})	1.5	0.01
Final baseline concentration (B_f)	5.25	0.01
Final ambient test booth challenge concentration (C_f)	95.5	100.0

The average corrected respirator sampled leakage (as a percent), for a particular exercise, is given by:

$$RE_{(cor,\ x)} = \left[(RE_x)(KE) - \frac{(B_i + B_f)(K_{bc})}{2} \right] \quad (7)$$

where

$RE_{(cor,\ x)}$ = average corrected respirator sampled leakage (as a percent) for a particular exercise x, for x = {NB, DB, TH, UD, T, or FG}

RE_x = average respirator sampled leakage determined from a strip-chart recording for a particular exercise x, for x = {NB, DB, TH, UD, T, or FG}

KE = instrument's sampling range switch position used during the exercise measurement (typically 10.0-0.01 percent)

B_i = initial baseline concentration

B_f = final baseline concentration

K_{bc} = instrument's sampling range switch position (typically 10.0-0.01 percent).

Thus, Equation (5) can be rewritten as:

$$PF_x = \left[\frac{C_{cor}}{RE_{(cor,\ x)}} \right] \quad (8)$$

where

PF_x = protection factor for a particular exercise x, for x = {NB, DB, TH, UD, T, or FG}

C_{cor} = average corrected test booth ambient challenge concentration (as a percent)

$RE_{(cor, x)}$ = average corrected respirator sampled leakage (as a percent) for a particular exercise x, for x = {NB, DB, TH, UD, T, or FG}.

The results for the data in Table 1 (derived from the strip-chart recording in Fig. 5) are shown in Table 2.

TABLE 2. QUANTITATIVE FIT TEST PROTECTION FACTORS RECORD

Exercise	PF
Normal breathing (NB)	$1.0X10^{6a}$
Deep breathing (DB)	$2.0X10^{5}$
Turning head side-to-side with deep breathing (TH)	$5.1X10^{4}$
Moving head up-and-down with deep breathing (UD)	$5.7X10^{4}$
Talking (T)	$6.9X10^{4}$
Facial grimacing (FG)	$9.5X10^{4}$
Overall average PF = $2.5X10^{5}$	

[a]NOTE: Protection factors (PF) calculated to be greater than $1.0X10^{6}$ are always reported as $1.0X10^{6}$, because the instruments' sensitivity is limited to measuring PF's of $1.0X10^{6}$.

Although the strip-chart recorder data can be interpreted without significant mathematical rigor, this exercise can be exasperating when more than a dozen subjects are involved. Having analyzed a large volume of tests, I have developed an alternative method that utilizes the USAFSAM VAX 11/780 computer to perform these calculations. This automated scheme yields a data reduction turn-around time of approximately 4 min per subject vs. 20 min per subject by manual calculation.

USING A VOLTAGE-TO-FREQUENCY CONVERTER CIRCUIT TO DO TIME-AVERAGED INTEGRATION

The basic function of a voltage-to-frequency (V/F) converter is to transform a variable direct-current voltage (typically 0 - 10 volts) into a pulse train whose repetition rate (frequency) is a direct linear function of the input voltage. An excellent technique for precisely integrating an analog

voltage signal is simply to add a counter stage to the output of a V/F converter and accumulate the pulse count. By accumulating the V/F converter output pulses, the "area under the input voltage curve," or integral, is calculated.

The attractive features of the V/F integration technique stimulated the development and adaptation of an integrator design that is currently used with the USAFSAM RQFT sodium chloride instrument [37].

Description of the Voltage-to-Frequency (V/F) Integrator

A comprehensive theoretical description and design of a V/F integrator (Fig. 6) has been reported by this author in a recent publication [37]. The same design has been adapted, without modification, for use with the DEHP RQFT instrument. However, because the V/F integrator requires an input analog direct-current voltage signal spanning approximately 0-10 volts, and since the current-to-voltage operational amplifier circuit in the DEHP RQFT instrument generates an analog output voltage signal spanning 0-100 mV, a buffer power amplifier (Fig. 7) was designed to make the RQFT instrument's output signal compatible with the integrator. The optimum gain of the buffer power amplifier was empirically found to range between 50 and 70. This gain span amplified the DEHP RQFT instrument's photometer signal to range approximately 0 to 6 ± 1 volts; at the same time, the amplifier's stability was maximized, and the noise was minimized.

Adaptation of the V/F Integrator to the DEHP RQFT Instrument

Adaptation of the V/F integrator to the DEHP RQFT instrument is quite simple. The integrator's utility and compatibility can be appreciated by analyzing Figure 8. The buffer power amplifier is connected to the DEHP RQFT instrument at two readily accessible terminals, and a single connection is made between the amplifier's output and V/F integrator's input.

Data Collection with the DEHP RQFT Instrument and V/F Integrator

The collection of RQFT data for subsequent PF calculations is a simple process when the integrator is used. The data sheets used for this purpose are shown in Figures 9 and 10. After the DEHP RQFT instrument has reached its operating equilibrium (45 min), and the buffer power amplifier and V/F integrator electronics have stabilized (30 min), the test booth's challenge atmosphere concentration is checked; then the conventional procedure for setting the DEHP instrument's photometer gain and stray light potentiometers is accomplished. After these adjustments are made, a subject can be tested.

After the subject enters the test booth and makes the appropriate connections to the sampling line, breathing gas supply, and intercom, the subject's name, type of respirator, date, and time are recorded on the appropriate data collection form (Figs. 9 and 10). The average initial voltage associated with the maximum test booth challenge concentration measurement is made.

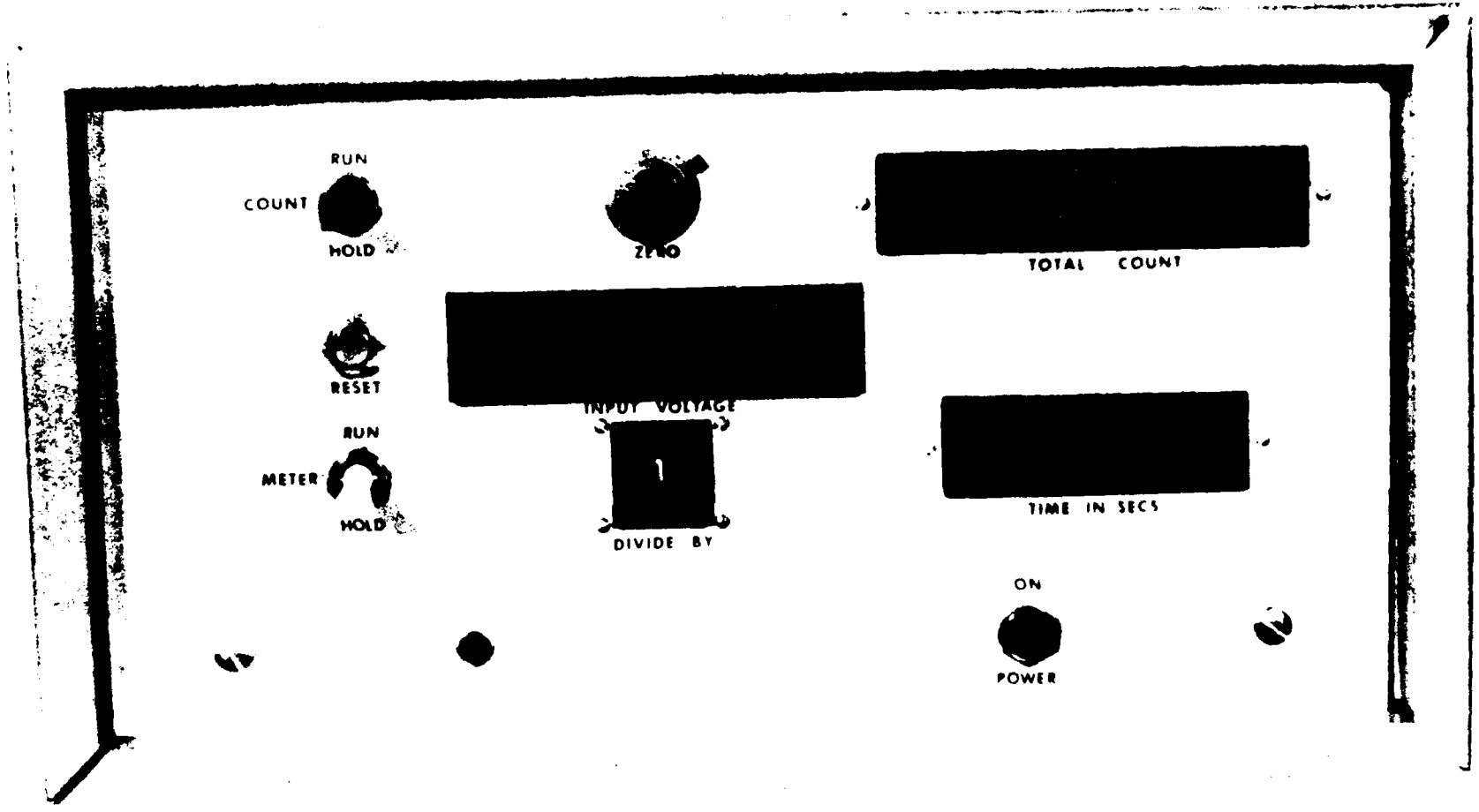

Figure 6. USAFSAM voltage-to-frequency integrator.

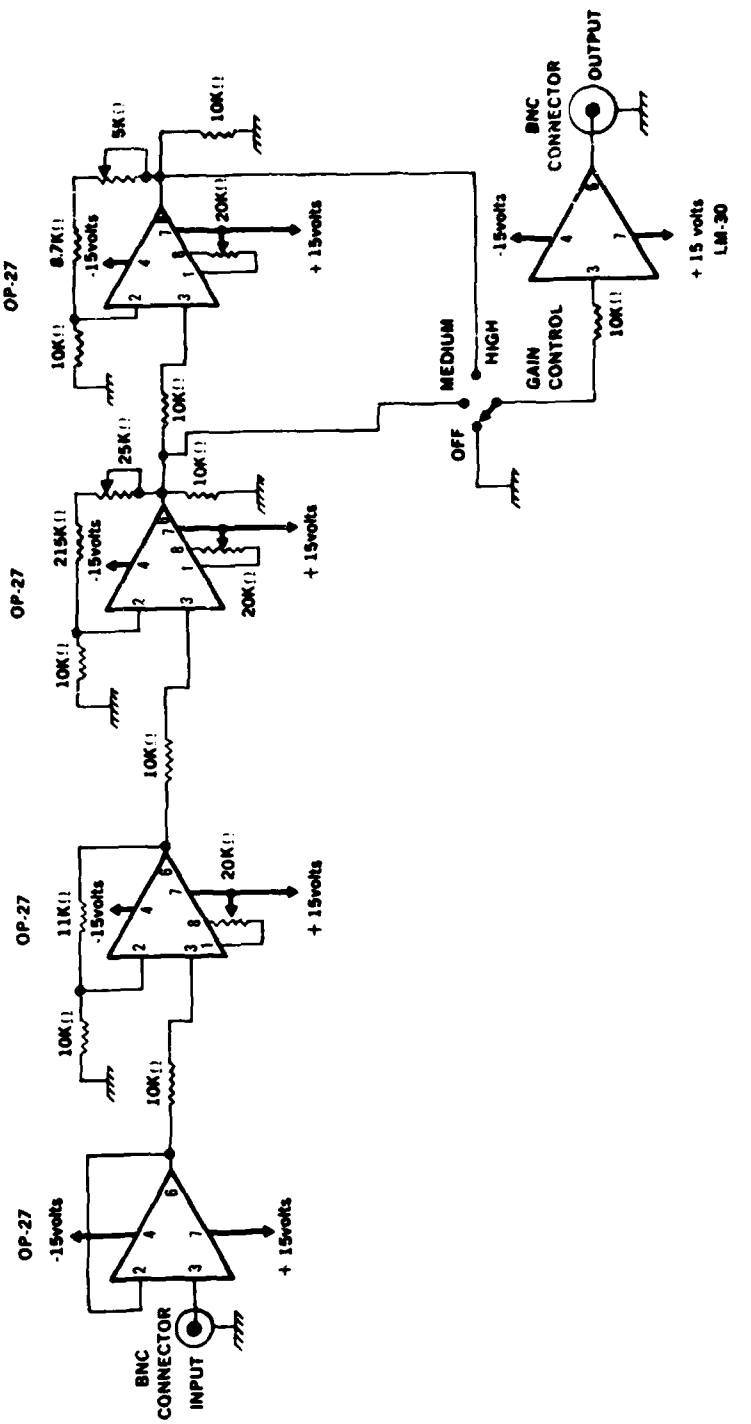

Figure 7. Di-2-ethylhexyl phthalate buffer power amplifier circuit.

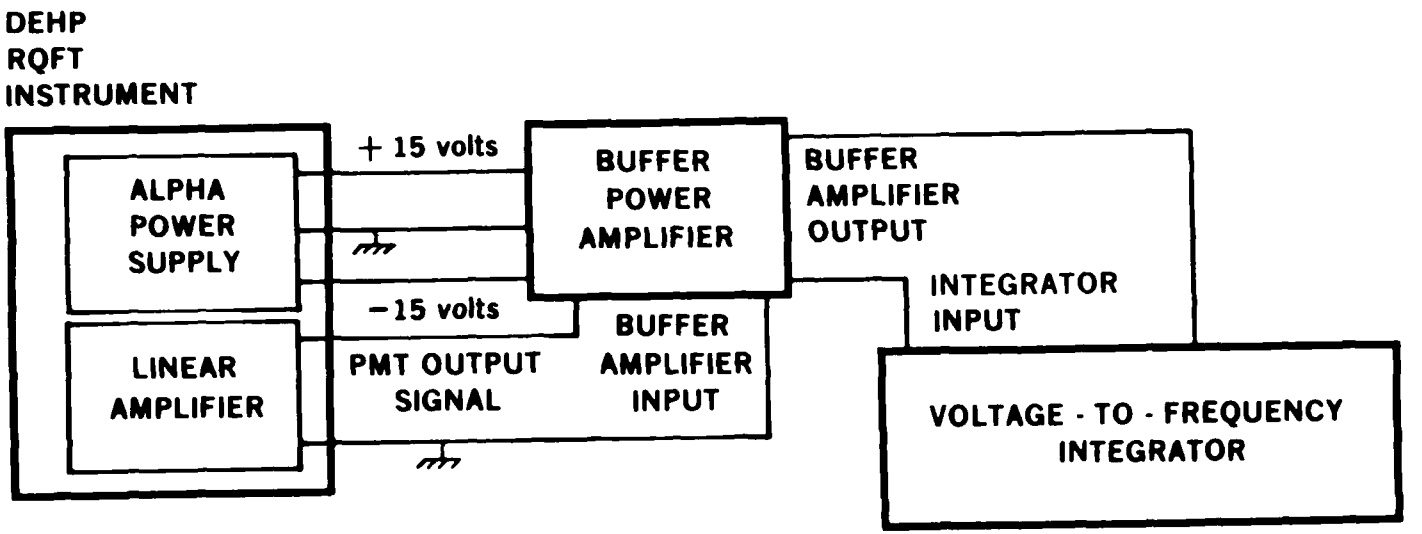

Figure 8. Adaptation of the V/F integrator to the di-2-ethylhexyl phthalate instrument.

DEHP RQFT DATA

SUBJECT NAME: _____
TYPE OF RESPIRATOR: _____
DATE TESTED: _____
TIME TESTED: _____

DEHP RQFT CALIBRATION DATA:

CALIBRATION PARAMETER	SAMPLING RANGE SWITCH POSITION (AS A PERCENT)	AVERAGE VOLTAGE (IN VOLTS)
AVERAGE INITIAL VOLTAGE ASSOCIATED WITH THE MAXIMUM CHAMBER CHALLENGE CONCENTRATION		
AVERAGE INITIAL VOLTAGE ASSOCIATED WITH THE BASELINE OF THE DEHP RQFT INSTRUMENT		
AVERAGE FINAL VOLTAGE ASSOCIATED WITH THE BASELINE OF THE DEHP RQFT INSTRUMENT		
AVERAGE FINAL VOLTAGE ASSOCIATED WITH THE MAXIMUM CHAMBER CHALLENGE CONCENTRATION		

EXERCISE INTEGRATOR COUNT INFORMATION:

EXERCISE	INTEGRATOR COUNT	TIME PERIOD (IN SECONDS)	SAMPLING RANGE SWITCH POSITION (AS A PERCENT)
NORMAL BREATHING STRAIGHT AHEAD			
DEEP BREATHING STRAIGHT AHEAD			
TALKING			
SIDE-TO-SIDE HEAD MOVEMENTS (DEEP BREATHING)			
UP-AND-DOWN HEAD MOVEMENTS (DEEP BREATHING)			
FACIAL GRIMACING			

Figure 9. Di-2-ethylhexyl phthalate RQFT data collection form No. 1.

DEHP RQFT DATA

SUBJECT NAME: _____
TYPE OF RESPIRATOR: _____
DATE TESTED: _____
TIME TESTED: _____

DEHP RQFT CALIBRATION DATA:

CALIBRATION PARAMETER	SAMPLING RANGE SWITCH POSITION (AS A PERCENT)	AVERAGE VOLTAGE (IN VOLTS)
AVERAGE INITIAL VOLTAGE ASSOCIATED WITH THE MAXIMUM CHAMBER CHALLENGE CONCENTRATION		
AVERAGE INITIAL VOLTAGE ASSOCIATED WITH THE BASELINE OF THE DEHP RQFT INSTRUMENT		
AVERAGE FINAL VOLTAGE ASSOCIATED WITH THE BASELINE OF THE DEHP RQFT INSTRUMENT		
AVERAGE FINAL VOLTAGE ASSOCIATED WITH THE MAXIMUM CHAMBER CHALLENGE CONCENTRATION		

EXERCISE INTEGRATOR COUNT INFORMATION:

EXERCISE	INTEGRATOR COUNT	TIME PERIOD (IN SECONDS)	SAMPLING RANGE SWITCH POSITION (AS A PERCENT)
NORMAL BREATHING STRAIGHT AHEAD			
NORMAL BREATHING LEFT			
NORMAL BREATHING RIGHT			
NORMAL BREATHING DOWN			
NORMAL BREATHING UP			
DEEP BREATHING STRAIGHT AHEAD			
DEEP BREATHING LEFT			
DEEP BREATHING RIGHT			
DEEP BREATHING DOWN			
DEEP BREATHING UP			
TALKING			
FACIAL GRIMACING			
SIDE-TO-SIDE HEAD MOVEMENTS (NORMAL BREATHING)			
UP-AND-DOWN HEAD MOVEMENTS (NORMAL BREATHING)			
SIDE-TO-SIDE HEAD MOVEMENTS (DEEP BREATHING)			
UP-AND-DOWN HEAD MOVEMENTS (DEEP BREATHING)			

Figure 10. Di-2-ethylhexyl phthalate RQFT data collection form No. 2.

This measurement is readily accomplished by reading the digital voltmeter on the V/F integrator's front panel (Fig. 6). This steady-state voltage and the associated sampling range switch position are recorded on the appropriate data collection form (Figs. 9 and 10). Next, the average initial voltage associated with the baseline of the DEHP RQFT instrument is made and recorded along with the corresponding sampling range switch position.

Because the output signal of the DEHP RQFT instrument is biased with a low-level noise component, the integrator must be adjusted to compensate for the noise before the exercises are initiated. The degree of compensation is accomplished by so rotating the integrator's PMT noise offset voltage adjustment potentiometer (Fig. 6) that a setting is found where the integrator count stops accumulating. This adjustment is accomplished immediately after having made the average initial voltage measurement associated with the baseline of the DEHP RQFT instrument. The exercise protocol can now be initiated.

After each exercise is accomplished, the following information is recorded: the integrator count on the 6-digit light-emitting diode (LED) display (Fig. 6); the time period on the 4-digit LED display (Fig. 6); and the RQFT instrument's sampling range switch position. The elapsed-time 4-digit LED display (Fig. 6) is used to initiate and terminate each exercise. Before proceeding to the next exercise, the integrator displays are reset to zero (Fig. 6). After the exercise measurements have been made, the average final voltage associated with the baseline of the DEHP RQFT instrument, and the sampling range switch position are recorded. The facts recorded are the average final voltage associated with the maximum test booth challenge concentration, and the sampling range switch position.

After all subjects have been tested, the user proceeds to a computer terminal and enters the information from the data collection forms. The interactive PF calculation program described in the next section is used to process the RQFT data.

COMPUTER PROGRAM TO CALCULATE PROTECTION FACTORS

The primary advantages in using the integrator and computer algorithm to process the raw RQFT data are threefold. First, the V/F integrator has the ability to resolve very small voltage fluctuations that are characteristic of the DEHP RQFT photometer's response for the exercises performed. The sensitivity of the integrator is 1000 counts/volt•sec [37]. For a 1-sec interval, the integrator can resolve 0.001 volts (1 mV). The human eye, for instance, can only resolve one minor division on the strip-chart recording paper used with the instrument; that is, the human's resolution capability, on a comparable basis, is approximately 0.1 volts. Thus, a more accurate average respirator leakage measurement can be made with the V/F integrator, because it offers two orders of magnitude resolution improvement. Second, the use of the V/F integrator eliminates human error and variability associated with reading and interpolating strip-chart recordings. Third, the V/F integration scheme permits RQFT data to be reduced in approximately one-fifth the time required for manual calculations (4 min vs. 20 min).

Discussion of the Computer Algorithm to Calculate Protection Factors

The calculation of a respirator's PF is readily accomplished using Equations (5-8). Since a one-to-one correspondence exists between the scattered light photometer's output voltage and the sampled concentration of DEHP, Equation (6) can be rewritten as:

$$C_{cor} = \left[\frac{(VC_i + VC_f)(K_{cc})}{2} - \frac{(VB_i + VB_f)(K_{bc})}{2} \right] \quad (9)$$

where

C_{cor} = average corrected test booth ambient challenge concentration (as a percent)

VC_i = average initial voltage response associated with the test booth challenge concentration (corresponds to C_i)

VC_f = average final voltage response associated with the test booth challenge concentration (corresponds to C_f)

K_{cc} = instrument's sampling range switch position (typically 100.0 percent)

VB_i = average voltage response associated with the initial baseline concentration (corresponds to B_i)

VB_f = average voltage response associated with the final baseline concentration (corresponds to B_f)

K_{bc} = instrument's sampling range switch position (typically 10.0-0.01 percent).

The integrator count--the source of data used to calculate a respirator leakage concentration--is, in reality, a time-averaged voltage response. This fact can be derived through the following analyses:

a. Integrator sensitivity is 1000 counts/volt•sec.

b. Each exercise is performed for a predetermined length of time; for example, 10 sec

c. The integrator count (IC) value recorded for a particular exercise is actually the time-averaged area under the strip-chart recorder response (refer to Fig. 5).

Therefore,

$$IC\ (counts) = (1000\ counts/volt \cdot sec) \cdot (time\ in\ sec)(\overline{V}\ volts) \qquad (10)$$

or, rearranging Equation 10 yields

$$\overline{V}\ volts = \frac{(IC\ counts)(volt \cdot sec)}{(1000\ counts)(time\ in\ sec)} . \qquad (11)$$

Thus,

$$\overline{V}\ volts = \frac{IC}{(1000)(time\ in\ sec)} \qquad (12)$$

in which $\overline{V}$ volts is the time-averaged voltage for a particular exercise.

Thus, since a one-to-one correspondence exists between the scattered-light photometer's output voltage and the sampled concentration of DEHP, Equation (7) can be rewritten as:

$$RE_{(cor,\ x)} = \left[(VRE_x)(KE) - \frac{(VB_i + VB_f)(K_{bc})}{2} \right] \qquad (13)$$

where

$RE_{(cor,\ x)}$ = average corrected respirator sampled leakage (as a percent) for a particular exercise x, for x = {NB, DB, TH, UD, T, or FG}

VRE_x = average voltage response associated with the average respirator sampled leakage determined from the integration count for a particular exercise x, for x={NB, DB, TH, UD, T, or FG}

KE = instrument's sampling range switch position used during the exercise measurement time period (typically 10.0-0.01 percent)

VB_i = average voltage response associated with the initial baseline concentration (corresponds to B_i)

VB_f = average voltage response associated with the final baseline concentration (corresponds to B_f)

K_{bc} = instrument's sampling range switch position (typically 10.0-0.01 percent).

A computer program has been written to accept the DEHP RQFT instrument's calibration voltages, exercise integrator count data, time duration for each exercise, and the associated range switch positions. The program calculates: the corrected test booth ambient challenge concentration; the corresponding time-averaged voltage associated with each exercise; the corrected respirator sampled leakage for a particular exercise; an exercise protection factor; an arithmetic average protection factor for all exercises; and, finally, a time-weighted average protection factor for all exercises. Equations (3-5) and (8-13) are used in the computer program to accomplish the calculations.

The corresponding V/F integrator data associated with Figure 5 and Table 1 are shown in Table 3; and the computer calculated results, in Table 4. As shown by these illustrations, the results for manual and computer calculations are very similar.

Discussion of the Computer Program for Processing the DEHP RQFT Integrator Data

A single computer program, named DEHPRQFT.FOR, is used to process the exercise data collected with the V/F integrator. The purpose of DEHPRQFT.FOR is to use the RQFT information collected on the RQFT data form (Figs. 9 or 10) and calculate a set of PF's. The results of this program are stored on two disk files:

1. DATAX.XXX contains the initial calibration data, the test identification data, the time period for each exercise, a listing of the exercises performed, the associated integrator count values, and the sampling range switch positions.

2. CALCX.XXX contains a composite listing of the identification data, the exercises performed and their corresponding PF's, and the average PF's.

The DEHPRQFT.FOR program is documented with comments that define the variables and explain the mathematical operations performed. Therefore, a line-by-line analysis of the Fortran code is not included in this report. For the interested reader, however, the following information is available:

Appendix A: Technical Note - USAFSAM Di-2-ethylhexyl Phthalate (DEHP) Respirator Quantitative Fit Test (RQFT) Instrument (Dynatech Frontier Corporation Model FE259H) Calibration Procedure

Appendix B: DEHPRQFT.FOR Fortran listing

Appendix C: DATAX.XXX file contents for data in Table 3

Appendix D: CALCX.XXX file contents for data in Table 4

Appendix E: User's guide for the DEHPRQFT.FOR computer program.

CONCLUSION

The USAFSAM DEHP RQFT instrument satisfies the need for a simple and rugged, yet sensitive and accurate tool for fitting personnel with chemical warfare defense respirators. Because of this work, the man-hour savings per respirator fit trial have been reduced by more than 20 percent, and human mathematical errors have been eliminated.

TABLE 3. INTEGRATOR COUNT DATA FOR THE STRIP-CHART RECORDING IN FIGURE 5

DEHP RQFT DATA

SUBJECT NAME: CAPTAIN EDWARD S. KOLESAR, JR.
TYPE OF RESPIRATOR: USA XM-29; MEDIUM; NO GLASSES
DATE TESTED: 18 JUNE 1981
TIME TESTED: 1127 HRS

DEHP RQFT CALIBRATION DATA:

CALIBRATION PARAMETER	SAMPLING RANGE SWITCH POSITION (AS A PERCENT)	AVERAGE VOLTAGE (IN VOLTS)
AVERAGE INITIAL VOLTAGE ASSOCIATED WITH THE MAXIMUM CHAMBER CHALLENGE CONCENTRATION	100.00	5.820
AVERAGE INITIAL VOLTAGE ASSOCIATED WITH THE BASELINE OF THE DEHP RQFT INSTRUMENT	0.01	0.090
AVERAGE FINAL VOLTAGE ASSOCIATED WITH THE BASELINE OF THE DEHP RQFT INSTRUMENT	0.01	0.050
AVERAGE FINAL VOLTAGE ASSOCIATED WITH THE MAXIMUM CHAMBER CHALLENGE CONCENTRATION	100.00	5.800

EXERCISE INTEGRATOR COUNT INFORMATION:

EXERCISE	INTEGRATOR COUNT	TIME PERIOD (IN SECONDS)	SAMPLING RANGE SWITCH POSITION (AS A PERCENT)
NORMAL BREATHING STRAIGHT AHEAD	131	10	0.01
DEEP BREATHING STRAIGHT AHEAD	3757	10	0.01
TALKING	11871	10	0.01
SIDE-TO-SIDE HEAD MOVEMENTS (DEEP BREATHING)	11074	10	0.01
UP-AND-DOWN HEAD MOVEMENTS (DEEP BREATHING)	8997	10	0.01
FACIAL GRIMACING	6752	10	0.01

TABLE 4. PROTECTION FACTOR COMPUTER PROGRAM CALCULATIONS FOR THE DATA IN TABLE 3

THE DESCRIPTIVE AND PROTECTION FACTOR CALCULATIONS

SUBJECT NAME: CAPTAIN EDWARD S. KOLESAR, JR.
TYPE OF RESPIRATOR: USA XM-29; MEDIUM; NO GLASSES
DATE TESTED: 18 JUNE 1981
TIME TESTED: 1127 HRS

EXERCISE	PROTECTION FACTOR
NORMAL BREATHING STRAIGHT AHEAD	1.0E+06
DEEP BREATHING STRAIGHT AHEAD	1.9E+05
TALKING	5.2E+04
SIDE-TO-SIDE HEAD MOVEMENTS (DEEP BREATHING)	5.6E+04
UP-AND-DOWN HEAD MOVEMENTS (DEEP BREATHING)	7.0E+04
FACIAL GRIMACING	9.6E+04

OVERALL ARITHMETIC AVERAGE PROTECTION FACTOR FOR ALL CATEGORIES OF EXERCISES ACTUALLY PERFORMED = 2.4E+05

OVERALL TIME WEIGHTED AVERAGE PROTECTION FACTOR FOR ALL CATEGORIES OF EXERCISES ACTUALLY PERFORMED = 2.4E+05

NOTE: Any protection factor that is listed as 1.0E+06 has been assigned this value by default because the sensitivity of this RQFT instrument is at most one part in ten to the sixth. The integrator count value for a particular exercise in question is merely representative of integrating the electrical noise and the true protection factor is indeed greater than 1.0E+06. Any exercise scaled integrator count value yielding a protection factor greater than 1.0E+06 will be reported as 1.0E+06.

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APPENDIX A:

Technical Note

USAFSAM Di-2-ethylhexyl Phthalate Respirator Quantitative Fit Test Instrument (Dynatech Frontier Corporation Model FE259H) Calibration Procedure

Edward S. Kolesar, Jr., Captain, USAFSAM/VNL
Colette M. de la Barre, Staff Sergeant, USAFSAM/VNL

5 January 1981

--APPENDIX A--

USAFSAM Di-2-ethylhexyl Phthalate Respirator Quantitative Fit Test Instrument (Dynatech Frontier Corporation Model FE259H) Calibration Procedure

INTRODUCTION

The Dynatech Frontier Corporation Model FE259H polydispersed di-2-ethylhexyl phthalate (DEHP) respirator quantitative fit test (RQFT) instrument is designed to generate a liquid aerosol challenge atmosphere that is reproducible in particle size {[0.5 - 0.6 μm] - [mass median aerodynamic diameter (MMAD)]} and in concentration (25 ± 5 μg/liter) [1-6]. The major subsystems of the FE259H RQFT instrument are the Model FE971 linear forward light scattering photometer, an aerosol generator, a dilution air system, and a Model FE701 strip-chart recorder [1, 3-5]. When the FE259H instrument is used in conjunction with the Model FE222 test booth, measurements of RQFT protection factors (PFs) can be accomplished [2, 5].

This technical note describes the analytical procedures that can be used to generate and maintain a known test booth challenge concentration of DEHP (normally, 30 μg/liter for full-face respirator tests). Implementation of this procedure will require the operator to make only two adjustments to the instrument. After the ambient temperature (°F) and barometric pressure (cm Hg) are measured, the FE259H aerosol generator air pressure and aerosol dilution air differential pressure settings are made. These two settings will optimize the test booth's response time (time required for the test booth to attain an equilibrium aerosol challenge concentration from an initial start-up), and the instrument's dynamic capability to achieve and maintain a desired challenge aerosol concentration.

ANALYTIC PERFORMANCE EQUATIONS

Five equations predict the performance and operation of the USAFSAM DEHP RQFT instrument [1, 3-10]:

$$\dot{M}_g = CO_t \qquad \text{(A-1)}$$

$$P_q = (\dot{M}_g - a_o)/a_1 \qquad \text{(A-2)}$$

$$Q_g = b_1 P_g + b_o \qquad \text{(A-3)}$$

$$Q_d = Q_t - Q_g \qquad \text{(A-4)}$$

$$\Delta P = (Q_d/k)^2 \, (P/T) \qquad \text{(A-5)}$$

where,

ΔP = aerosol dilution air differential pressure setting [also the magnehelic water column gauge setting (inches of H_2O)]

P_g = aerosol generator air pressure (psig)

P = average ambient barometric pressure (cm of Hg)

$\dot{M}_g$ = aerosol generator mass flow rate (mg/min)

Q_t = total system volumetric aerosol flow rate (liters/min)

Q_d = volumetric dilution air flow rate (liters/min)

Q_g = volumetric aerosol generator flow rate (liters/min)

C = chamber concentration of DEHP (µg/liter)

T = average ambient temperature (°K)

a_o, a_1, b_o, b_1, and k = unique instrumental calibration constants supplied by the manufacturer.

For the USAFSAM instrument [1, 3-5]:

a_o = -23.9 mg/min

a_1 = 9.26 mg/min•psig

b_o = 17.2 liter/min

b_1 = 2.72 liters/min•psig

k = 119.0 liters•cm $Hg^{\frac{1}{2}}$/min•$°K^{\frac{1}{2}}$•$psig^{\frac{1}{2}}$

C = 30 µg/liter

EXAMPLE CALCULATION

As an example, a typical calculation can be accomplished considering the following conditions:

T = 72°F

P = 75 cm Hg

Q_t = 849.6 liters/min (30 cfm)

--APPENDIX A--

The aerosol generator's mass flow rate can be calculated using Equation (A-1):

$$\dot{M}_g = (30\ \mu g/liter)\ (1\ mg/1000\ \mu g)\ (849.6\ liters/min)$$

$$\dot{M}_g = 25.49\ mg/min$$

The aerosol generator pressure setting can be calculated using Equation (A-2):

$$P_g = \frac{(25.49\ mg/min) - (-23.9\ mg/min)}{(9.26\ mg/min \cdot psig)}$$

$$P_g = 5.33\ psig$$

The volumetric aerosol generator air flow rate can be calculated using Equation (A-3):

$$Q_g = (2.72\ liters/min \cdot psig)\ (5.33\ psig) + (17.2\ liters/min)$$

$$Q_g = 31.70\ liters/min$$

The volumetric dilution air flow rate can be calculated using Equation (A-4):

$$Q_d = (849.6\ liters/min) - (31.70\ liters/min)$$

$$Q_d = 817.9\ liters/min$$

Finally, the aerosol dilution air differential pressure setting can be calculated using Equation (A-5):

$$\Delta P = \frac{\frac{817.9\ liters}{min}}{\frac{119\ liters \cdot cm\ Hg^{\frac{1}{2}}}{min \cdot {}^{\circ}K^{\frac{1}{2}} \cdot psig}} \cdot \left[\frac{(75\ cm\ Hg)}{(295.4\ {}^{\circ}K)}\right]$$

ΔP = 12.0 psig

where

°K = (°F-32) 5/9 + 273.15

Thus, for this example, the DEHP instrument's front panel aerosol generator air pressure gauge would be adjusted to 5.33 psig, and the aerosol dilution air differential pressure (magnehelic gauge) would be adjusted to 12.0 psig. These settings (at the temperature and barometric pressure considered) mean that the test booth's concentration of DEHP will be established and maintained at 30 µg/liter.

CONCLUSION

Because the aerosol generator air pressure and aerosol dilution air differential pressure (magnehelic gauge) must be adjusted for ambient temperature and barometric pressure, a table of these two settings can be constructed for various combinations of ambient temperatures and barometric pressures.

Figure A-1 illustrates the organization of Table A-1. To use Table A-1, the technician should: first, identify the aerosol generator air pressure he would like to use; second, identify the ambient temperature and barometric pressure; and, finally, read from the Table (an element x_{ij}) the aerosol dilution air differential pressure (magnehelic gauge) setting. If the situation arises that the magnehelic gauge setting is off-scale for the instrument, the technician should select a different aerosol generator air pressure setting and repeat the foregoing iterative process. Table A-1 will facilitate calibration of the instrument by the laboratory technician.

The following pages ("Attachment A-1") contain Figure A-1 and the computer-generated information for Table A-1. (Thereafter, "Attachment A-2" provides a listing of the Fortran computer program used to generate the data in Table A-1).

REFERENCES

1. Frontier Enterprises, Incorporated. Customer training workship and seminar series manual: Aerosol instrumentation for respiratory protective apparatus testing and training (DOP quantitative man fit testing - DOP apparatus quality surveillance testing), 12 June 1978.

2. Frontier Enterprises, Incorporated. Some general properties of airborne particulates. Technical Note TN 106.000, 14 Mar 1974.

NOTE: Frontier Enterprises, Incorporated, is now Dynatech Frontier Corporation, Albuquerque, N. Mex.

3. Frontier Enterprises, Incorporated. Aerosol concentration calculation procedures for the Model FE259H DOP aerosol test system. Technical Note TN 108.0001, 6 Feb 1976.

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5. Dynatech Frontier Corporation. Polydispersed DOP aerosol system Model FE259H operating manual, Albuquerque, N. Mex., 18 Apr 1980.

6. Dynatech Frontier Corporation. Photometric measurement of respirator quantitative fit test protection factors and their interpretation, use, and meaning. Albuquerque, N. Mex., 18 Nov 1978.

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8. Echols, W. H., and J. A. Young. Studies of portable air-operated aerosol generators. NRL Report 5929. U.S. Naval Research Laboratory, Chemistry Division, Washington, D.C., 16 July 1963.

9. Davis, C. H. (ed.). Aerosol science. New York: Academic Press, 1966.

10. Hidy, G. M., and J. R. Brock. The dynamics of aerocolloidal systems. Int Rev Aerosol and Chemistry 1:1 (1970).

--APPENDIX A--

ATTACHMENT A-1:

Figure A-1 and Table A-1

AEROSOL GENERATOR AIR PRESSURE (PSIG) = (DESIRED SETTING)

Ambient Barometric Pressure in cm Hg

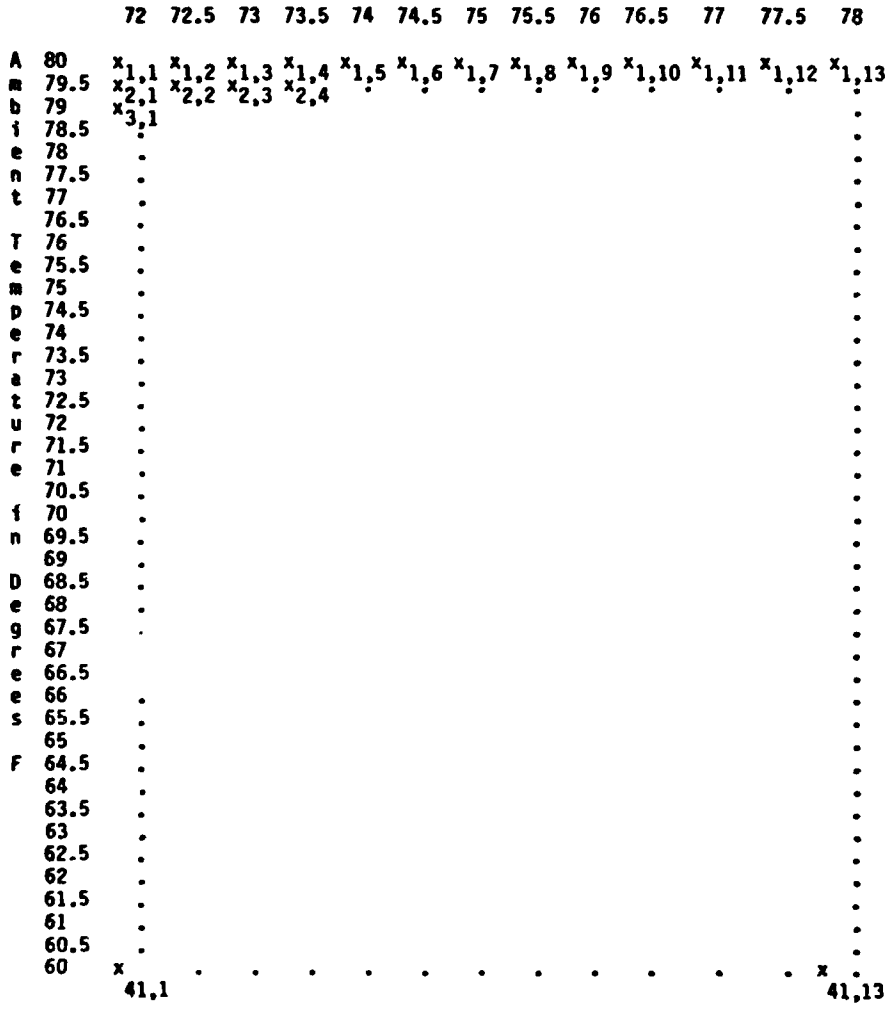


Figure A-1. Organization of data for Table A-1. (Aerosol generator air pressure vs. aerosol dilution air differential pressure--magnehelic gauge setting--for various ambient temperatures and barometric pressures.)

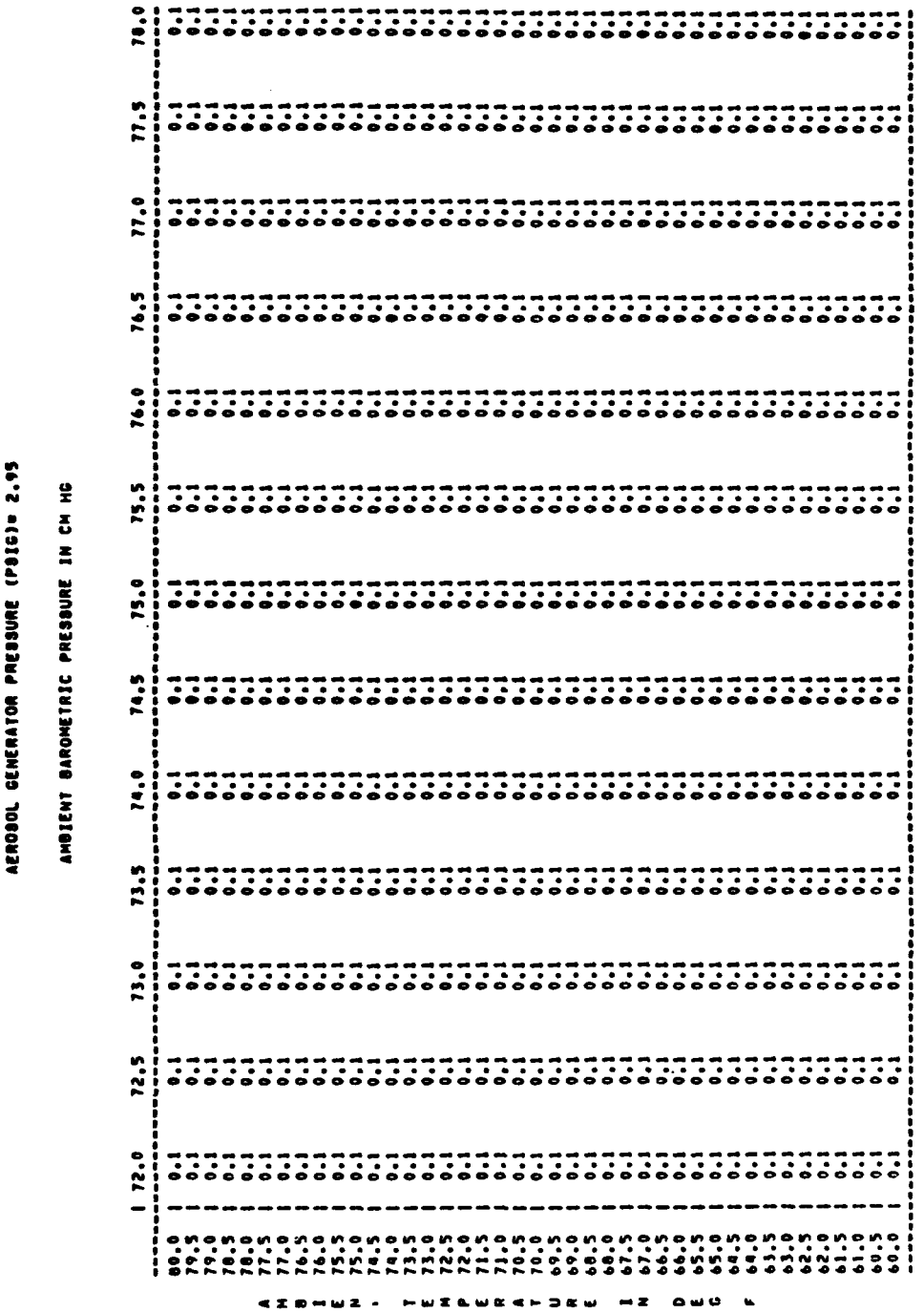
TABLE A-1. AEROSOL GENERATOR AIR PRESSURE VS. AEROSOL DILUTION AIR DIFFERENTIAL PRESSURE (MAGNEHELIC GAUGE SETTING) FOR VARIOUS AMBIENT TEMPERATURES AND BAROMETRIC PRESSURES

AEROSOL GENERATOR PRESSURE (PSIG)= 2.86

AMBIENT BAROMETRIC PRESSURE IN CM HG

AMBIENT TEMPERATURE IN DEG F	72.0	72.5	73.0	73.5	74.0	74.5	75.0	75.5	76.0	76.5	77.0	77.5	78.0
80.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
79.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
79.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
78.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
78.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
77.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
77.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
76.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
76.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
75.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
75.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
74.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
74.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
73.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
73.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
72.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
72.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
71.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
71.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
70.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
70.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
69.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
69.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
68.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
68.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
67.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
67.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
66.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
66.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
65.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
65.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
64.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
64.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
63.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
63.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
62.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
62.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
61.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
61.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
60.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
60.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

--APPENDIX A--
(Attachment A-1)



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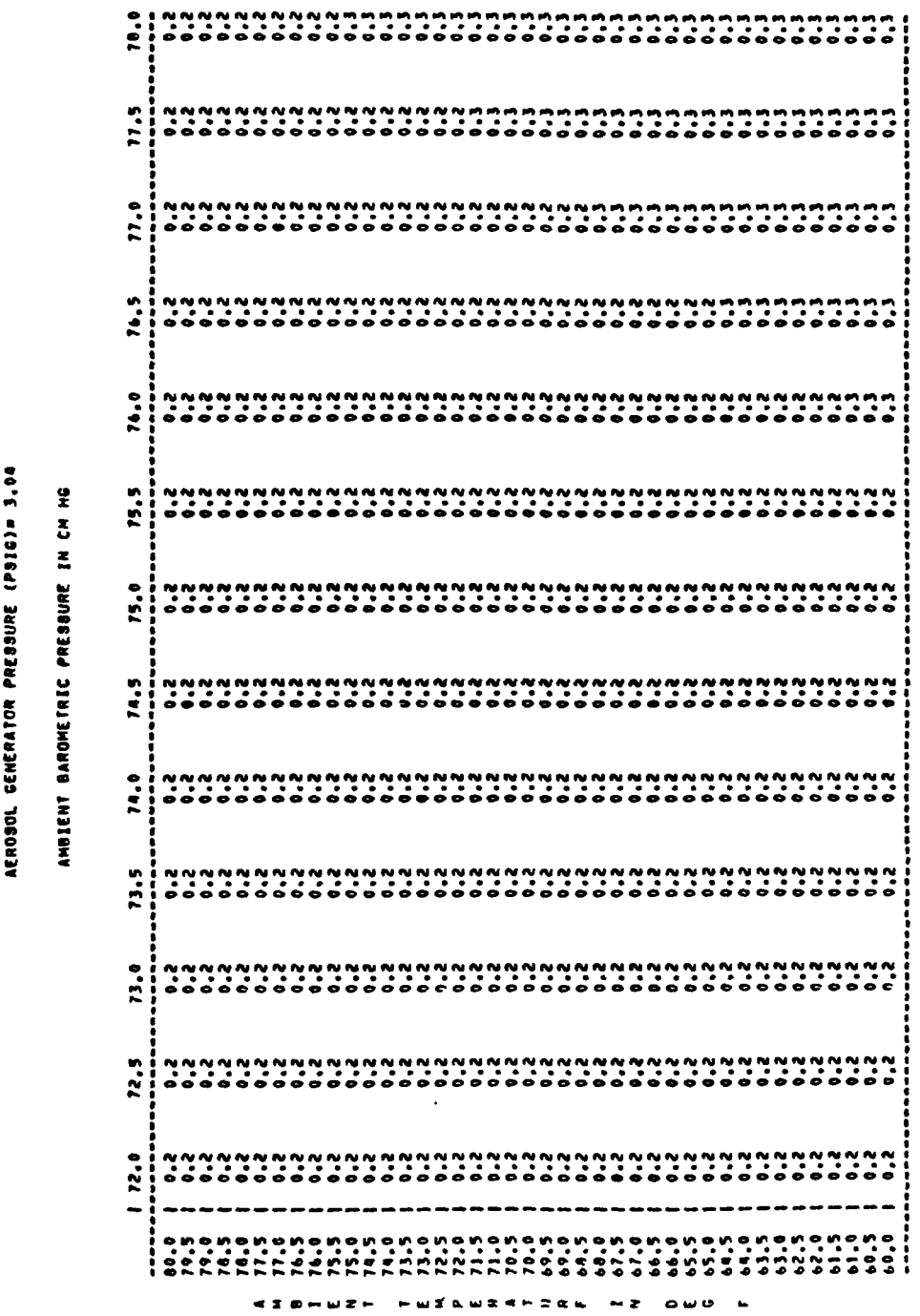

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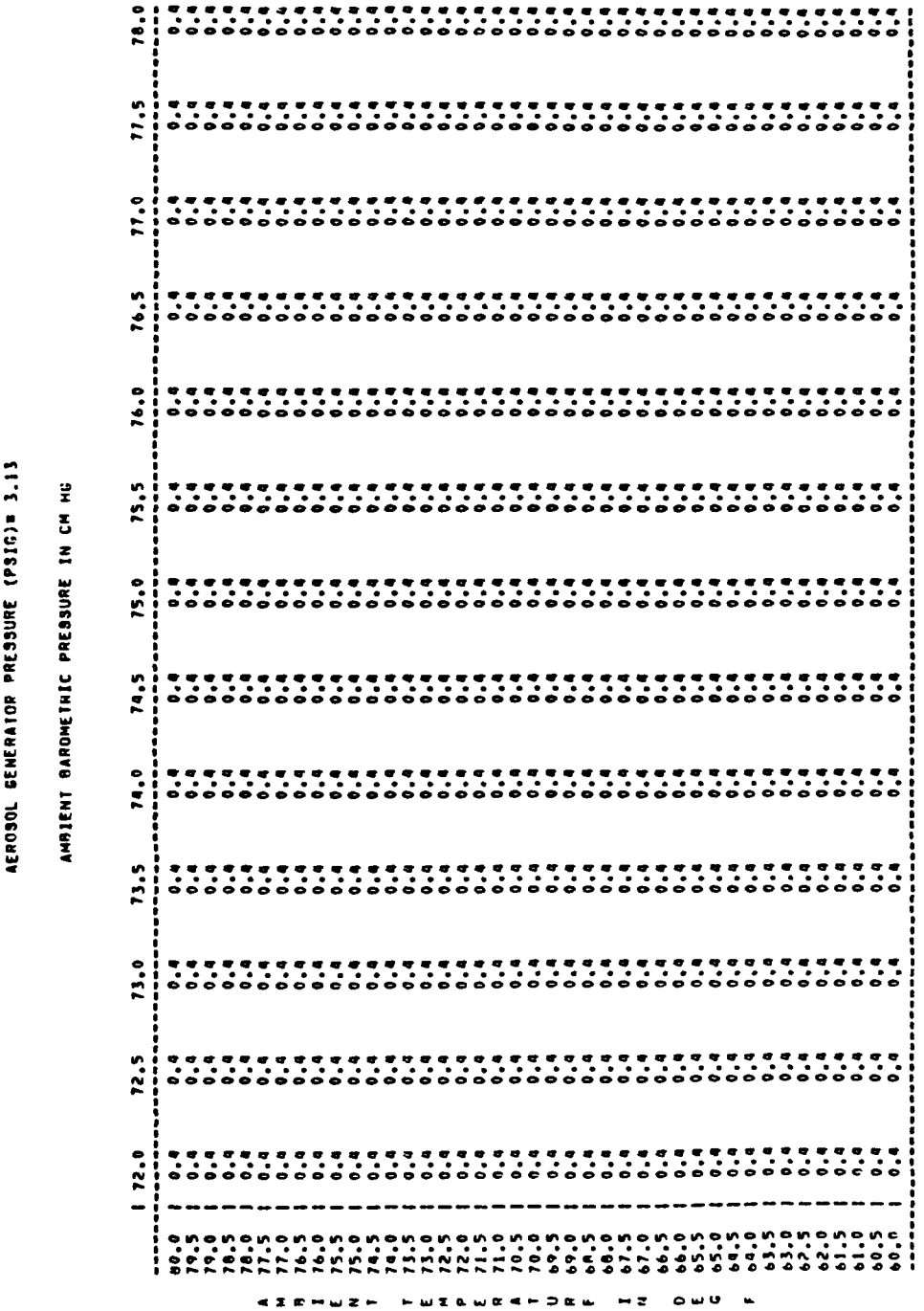

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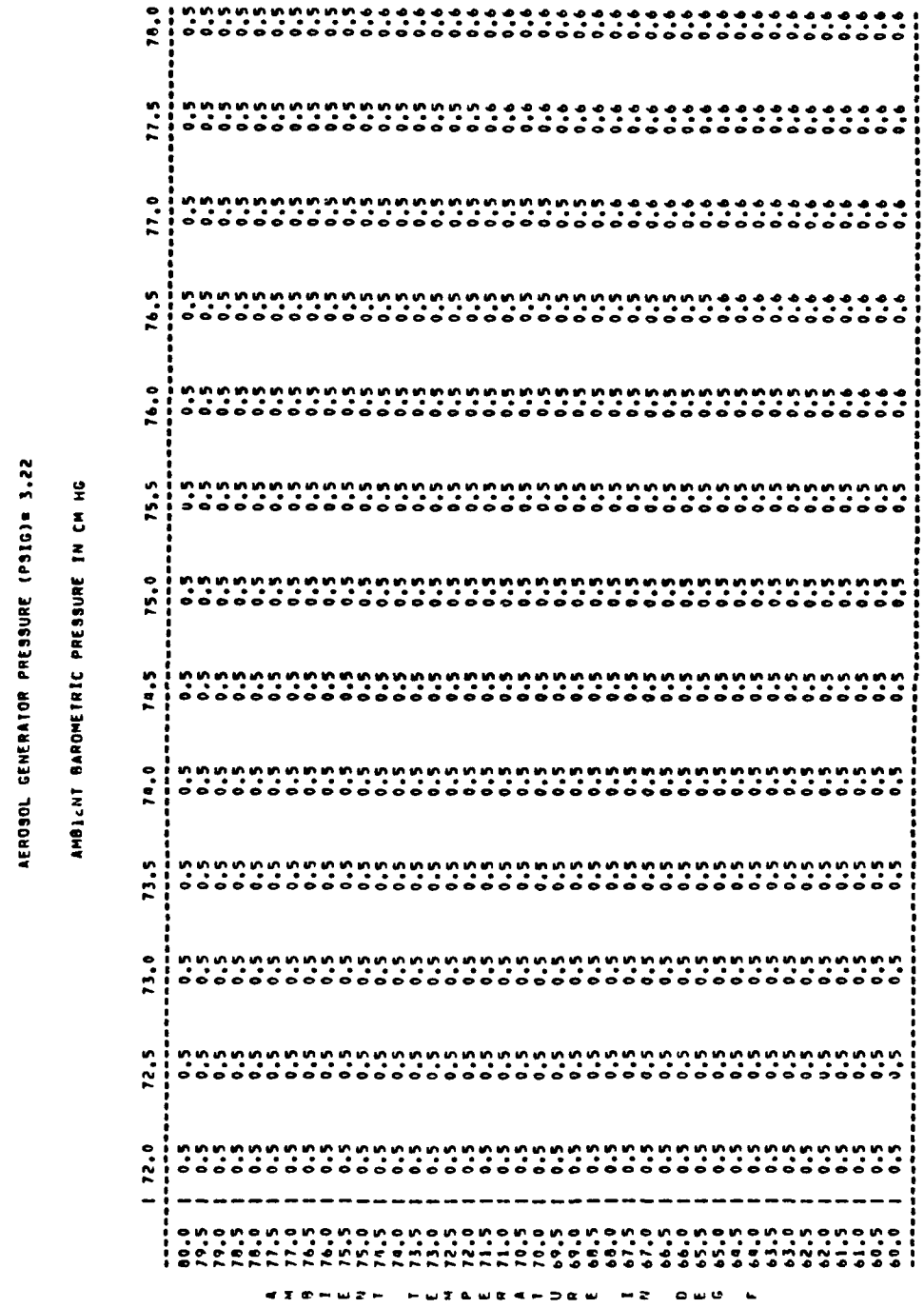


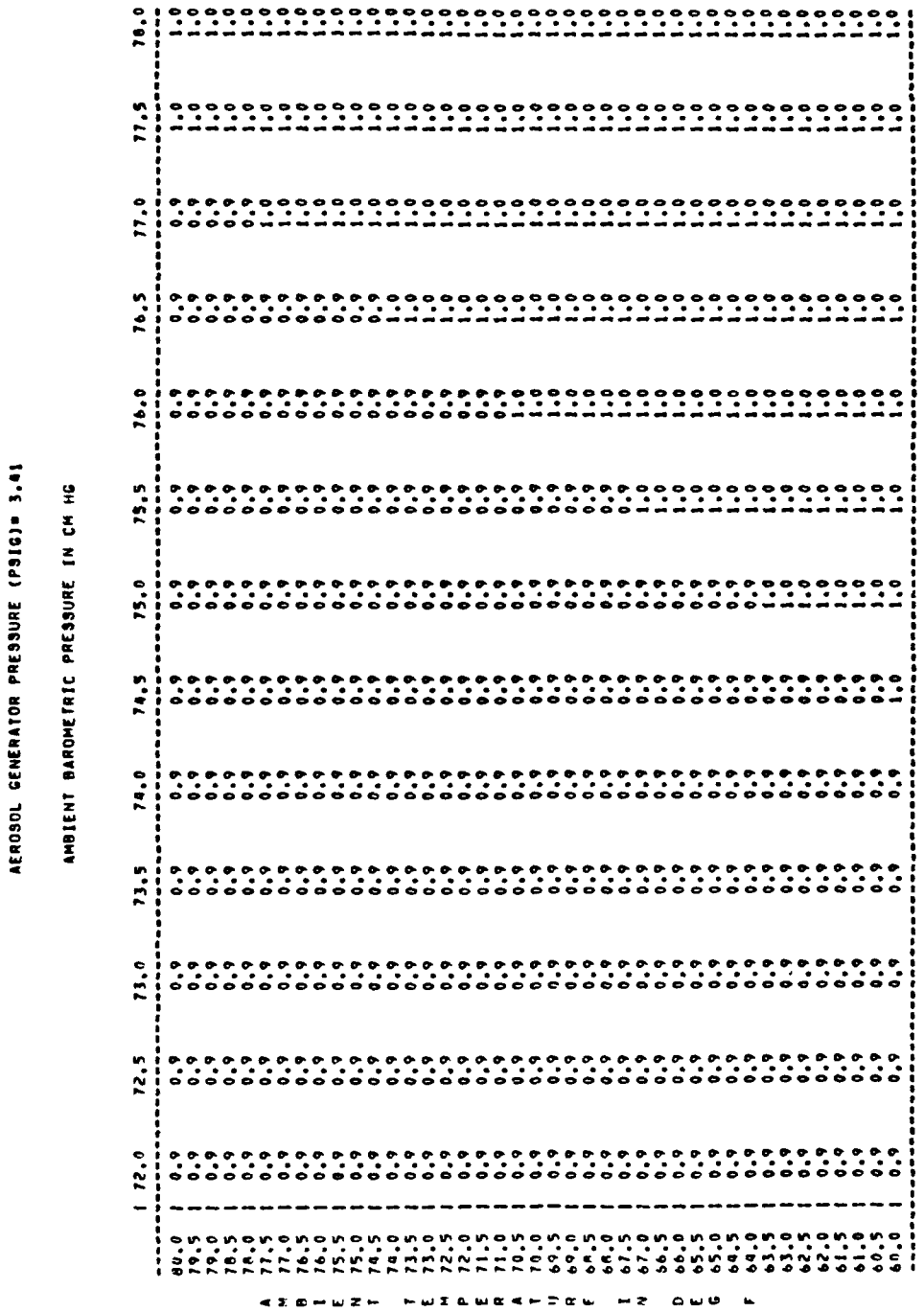
--APPENDIX A--
(Attachment A-1)

AEROSOL GENERATOR PRESSURE (PSIG)= 3.31

AMBIENT BAROMETRIC PRESSURE IN CM HG

AMBIENT TEMPERATURE F	72.0	72.5	73.0	73.5	74.0	74.5	75.0	75.5	76.0	76.5	77.0	77.5	78.0
80.0	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
79.5	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
79.0	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
78.5	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
78.0	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
77.5	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
77.0	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
76.5	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
76.0	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
75.5	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
75.0	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
74.5	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
74.0	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
73.5	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
73.0	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
72.5	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
72.0	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
71.5	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
71.0	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
70.5	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
70.0	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
69.5	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
69.0	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
68.5	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
68.0	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8
67.5	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8
67.0	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8
66.5	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8
66.0	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8
65.5	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8
65.0	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
64.5	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
64.0	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
63.5	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
63.0	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
62.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
62.0	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
61.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
61.0	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
60.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
60.0	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8

--APPENDIX A--
(Attachment A-1)



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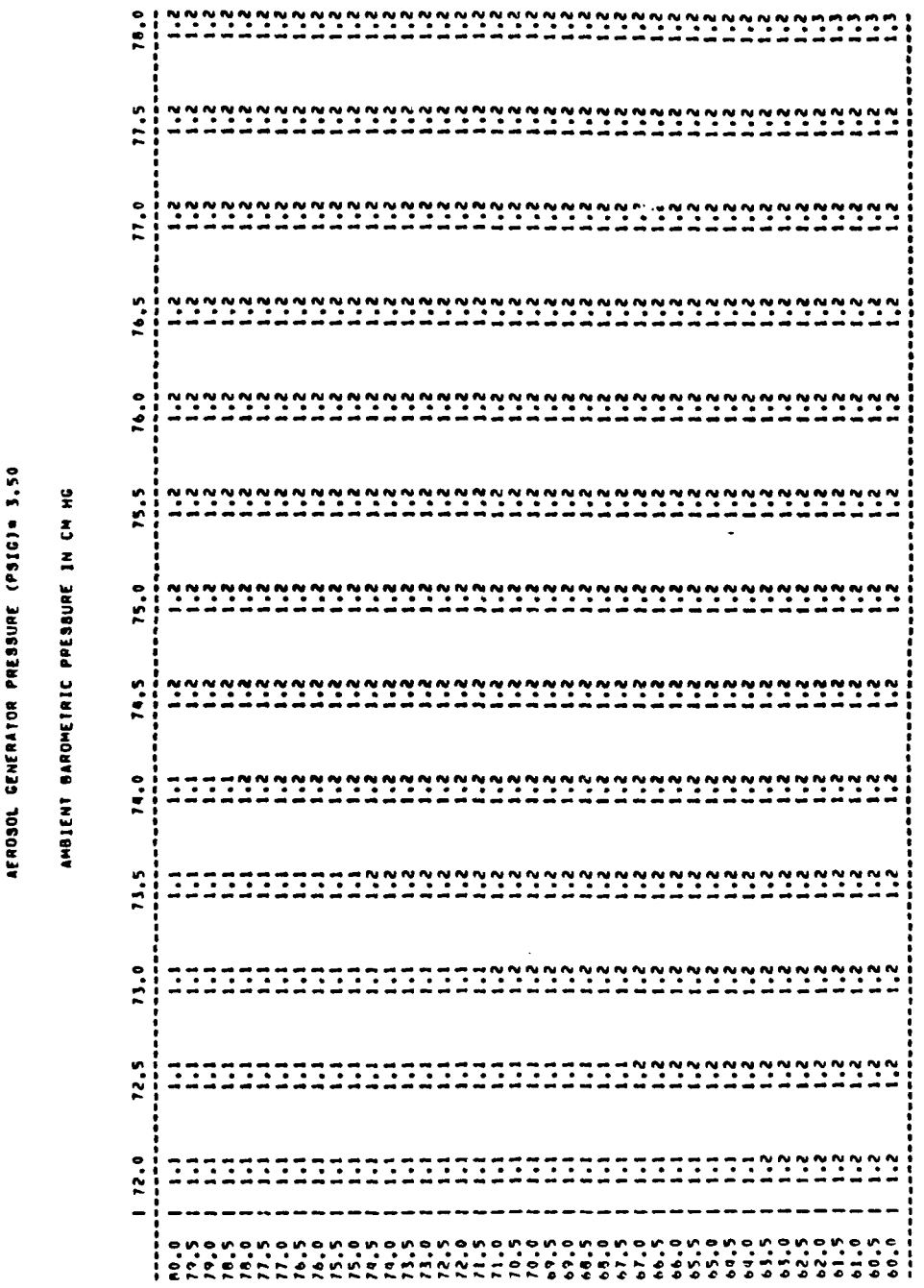

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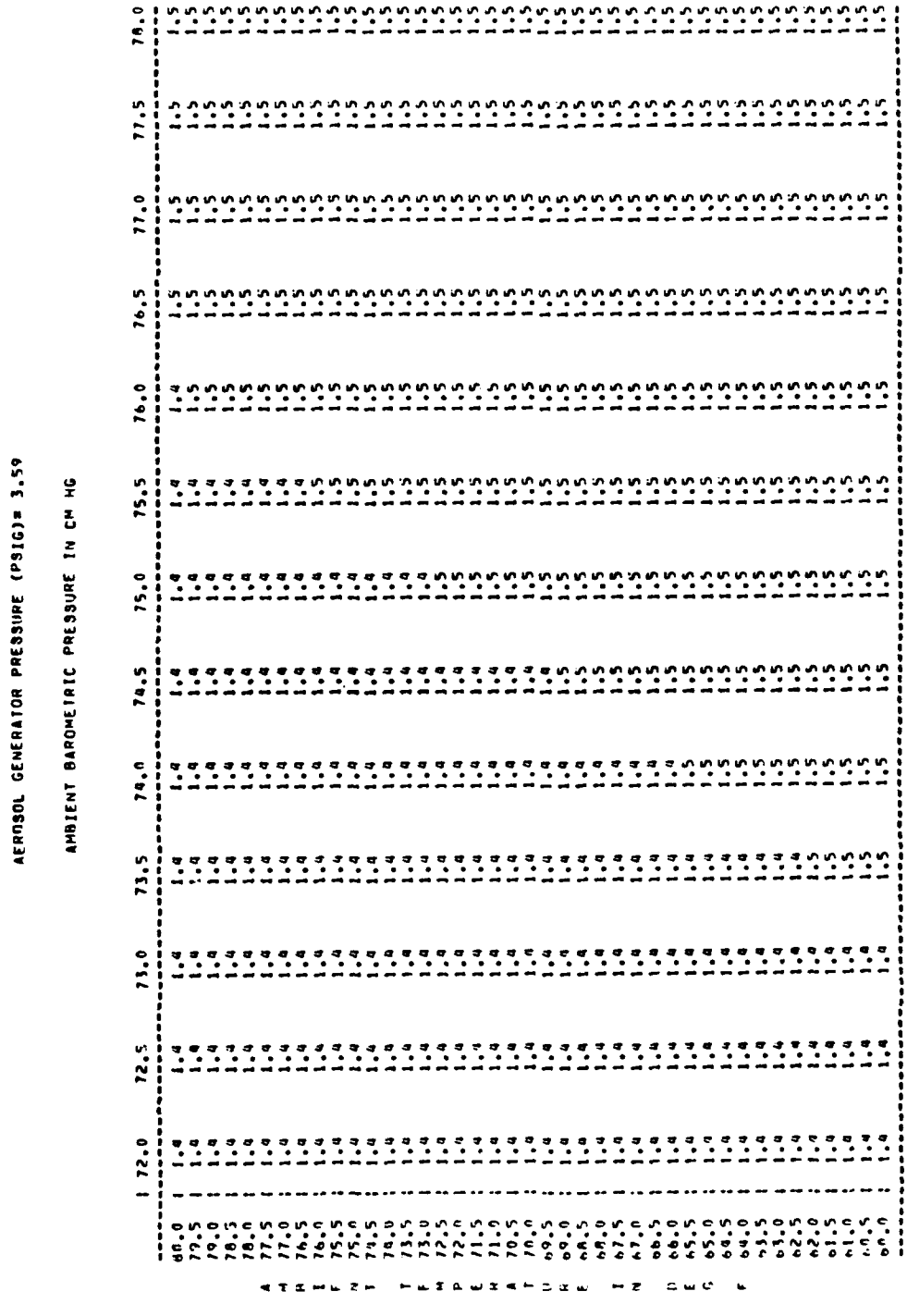

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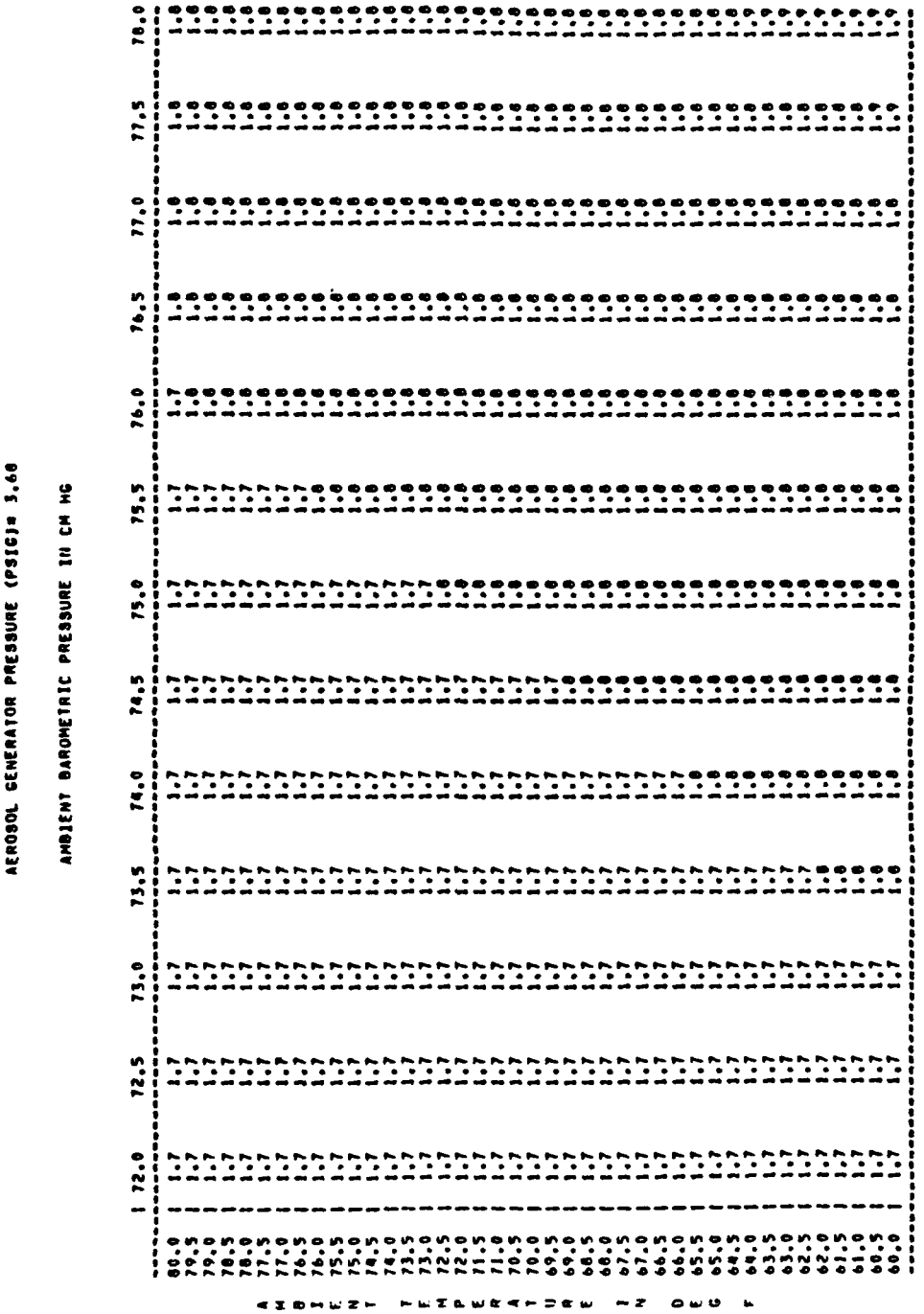

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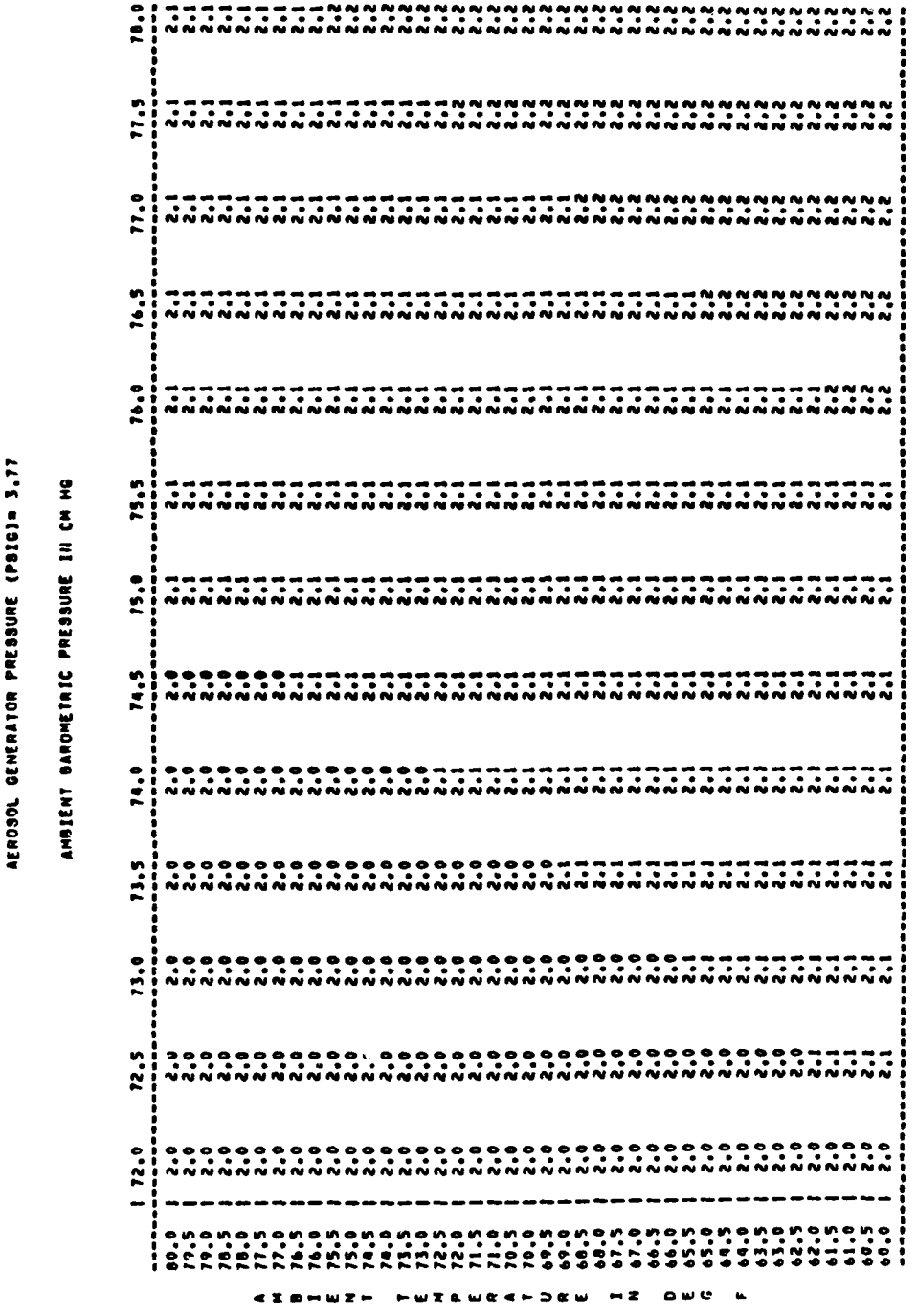

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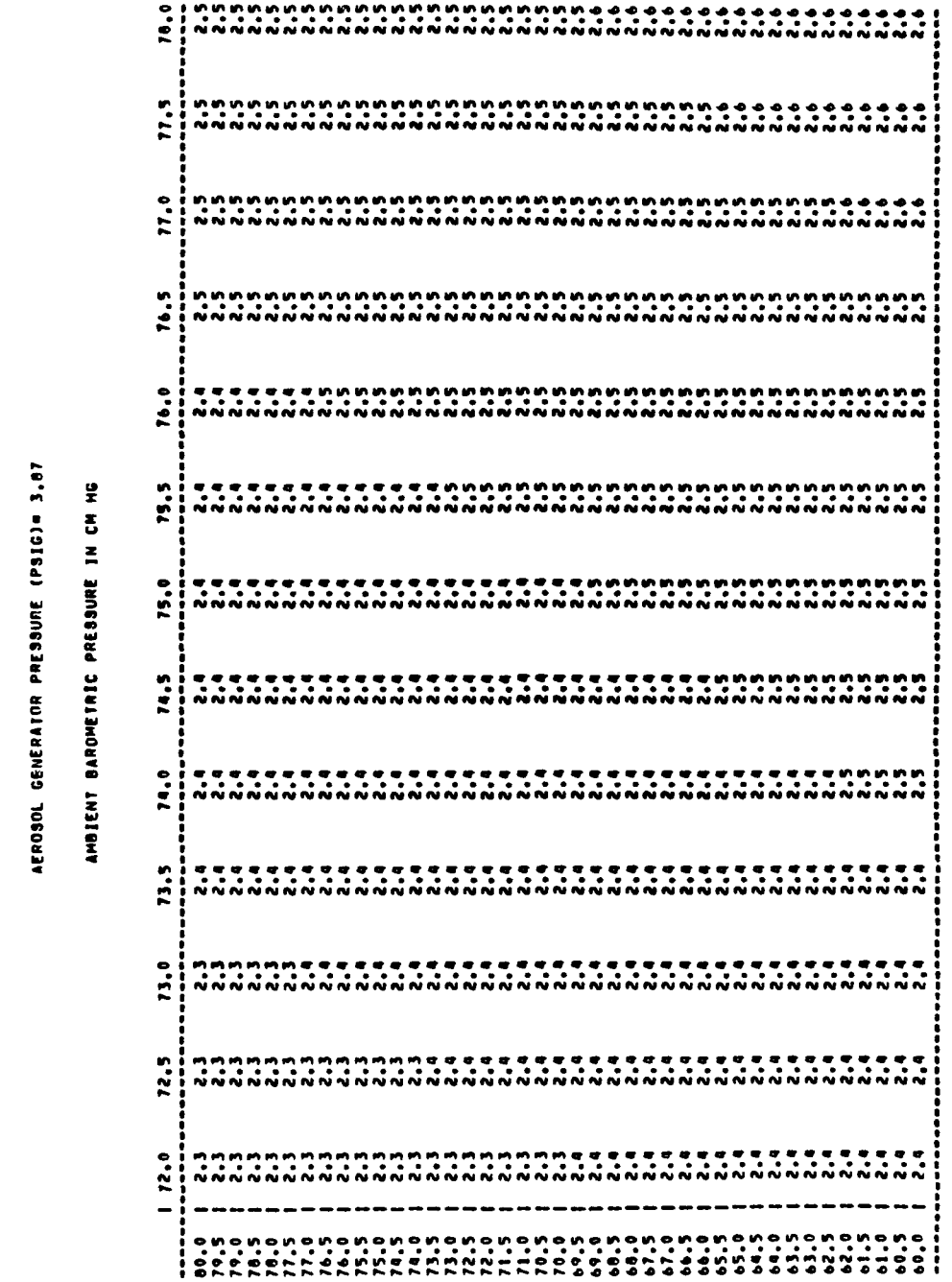

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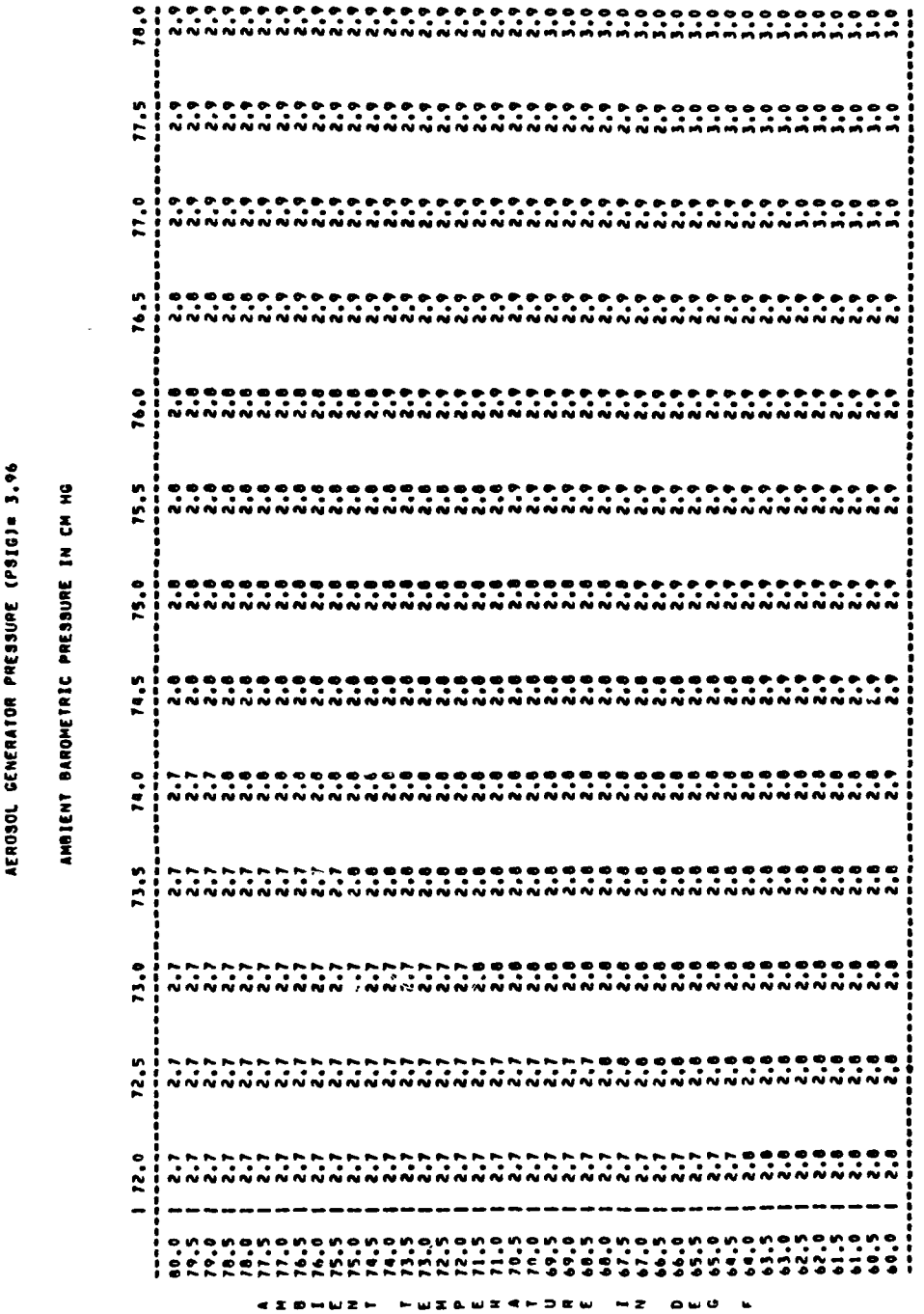

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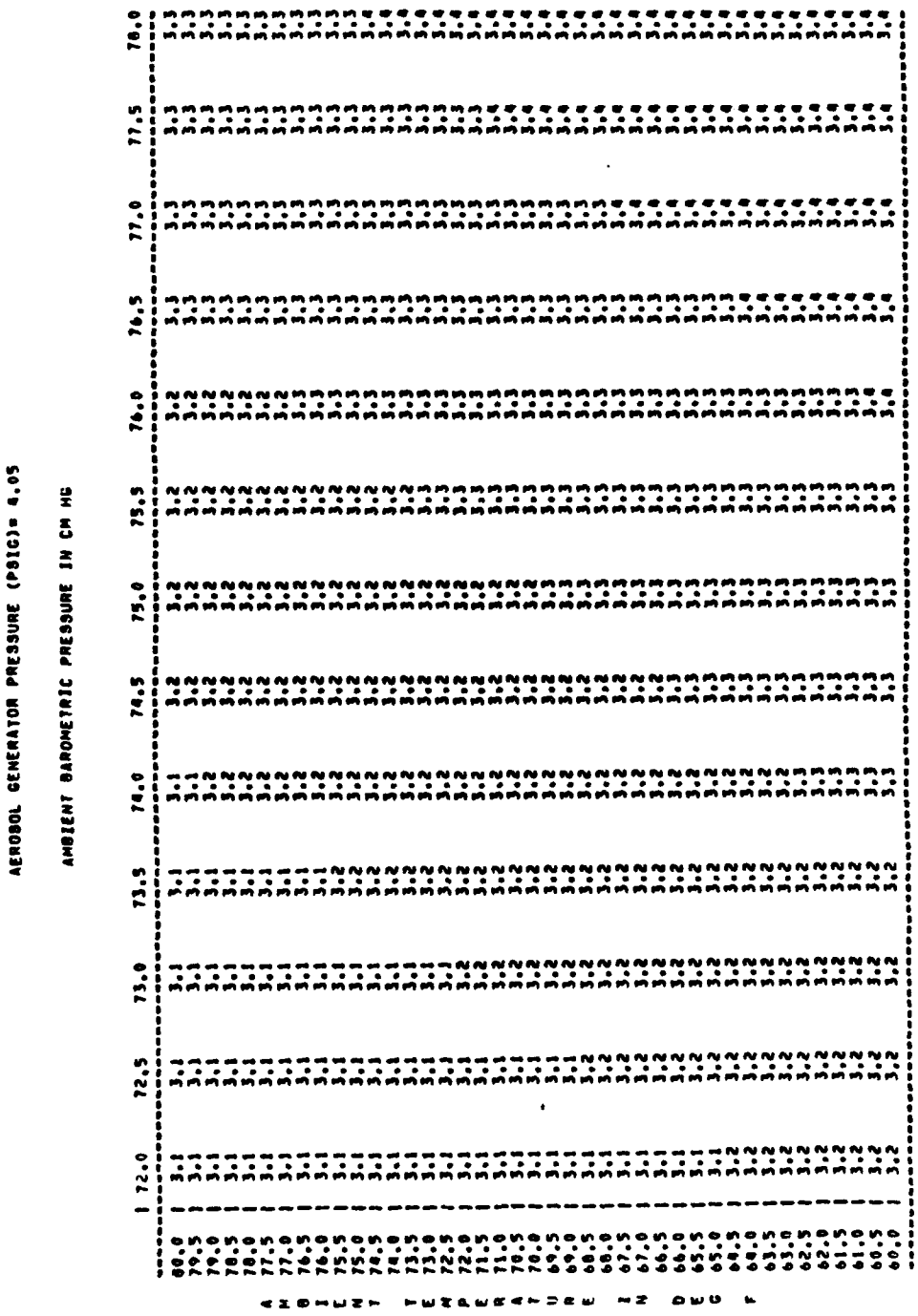
(Attachment A-1)



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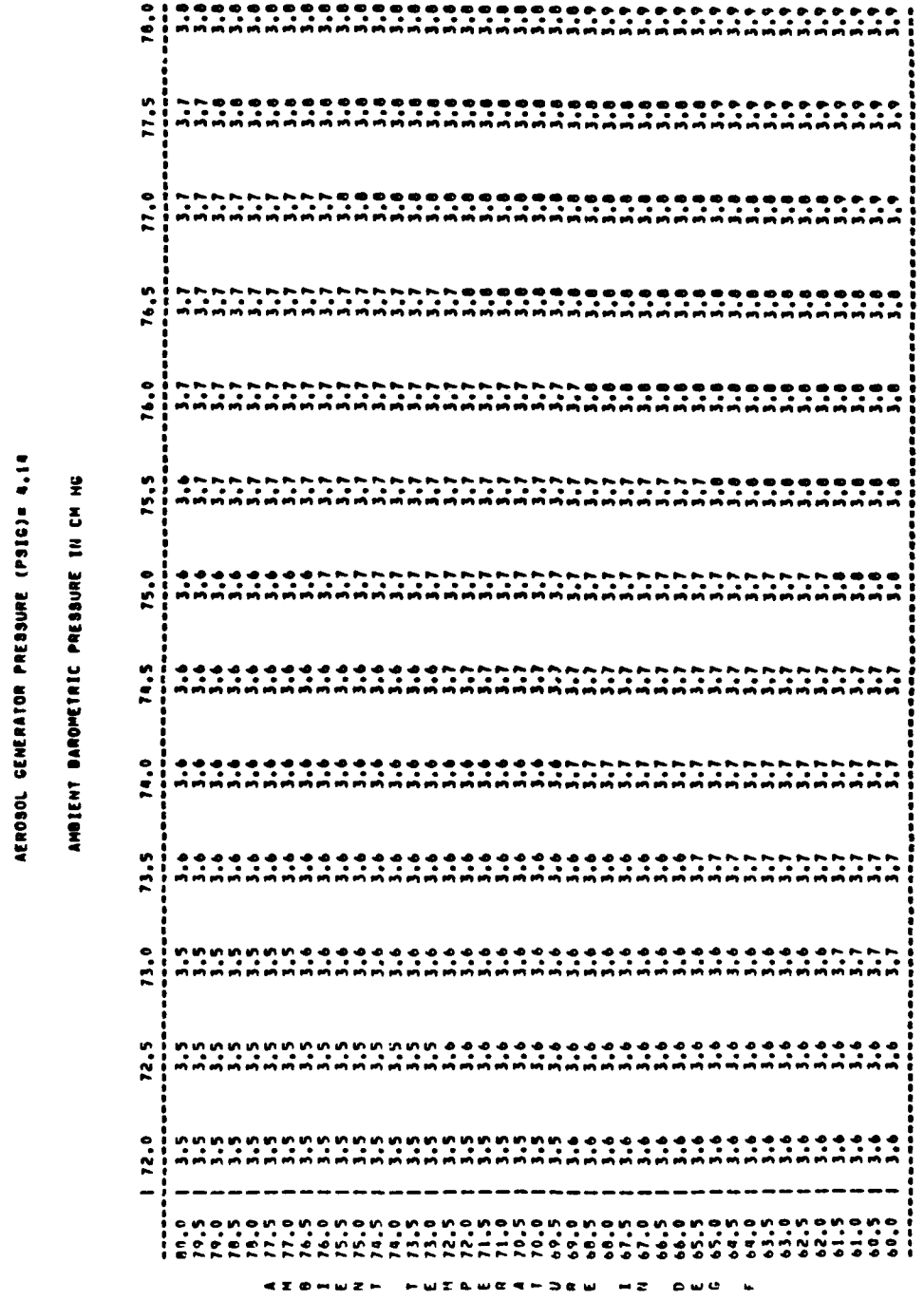

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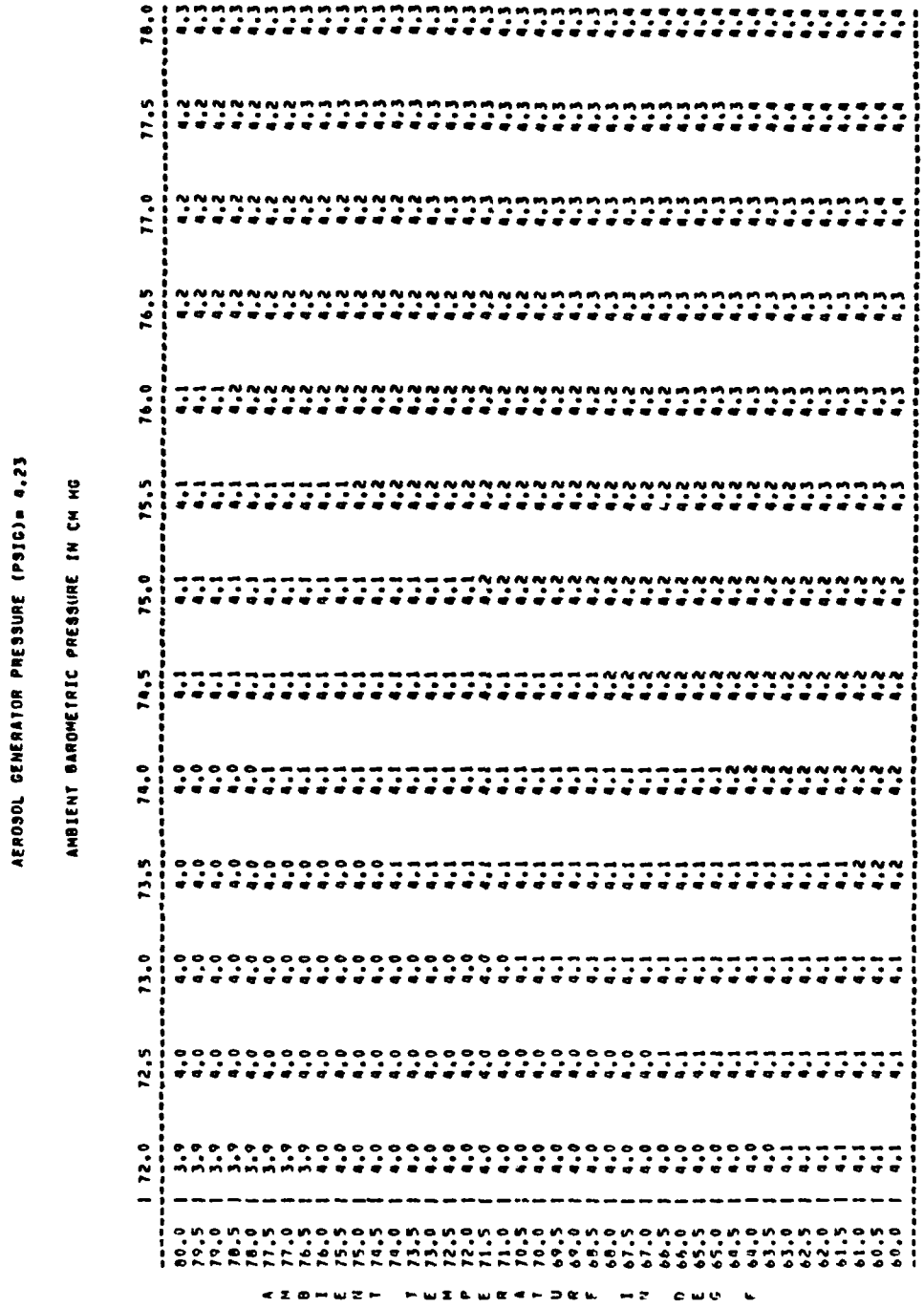
(Attachment A-1)



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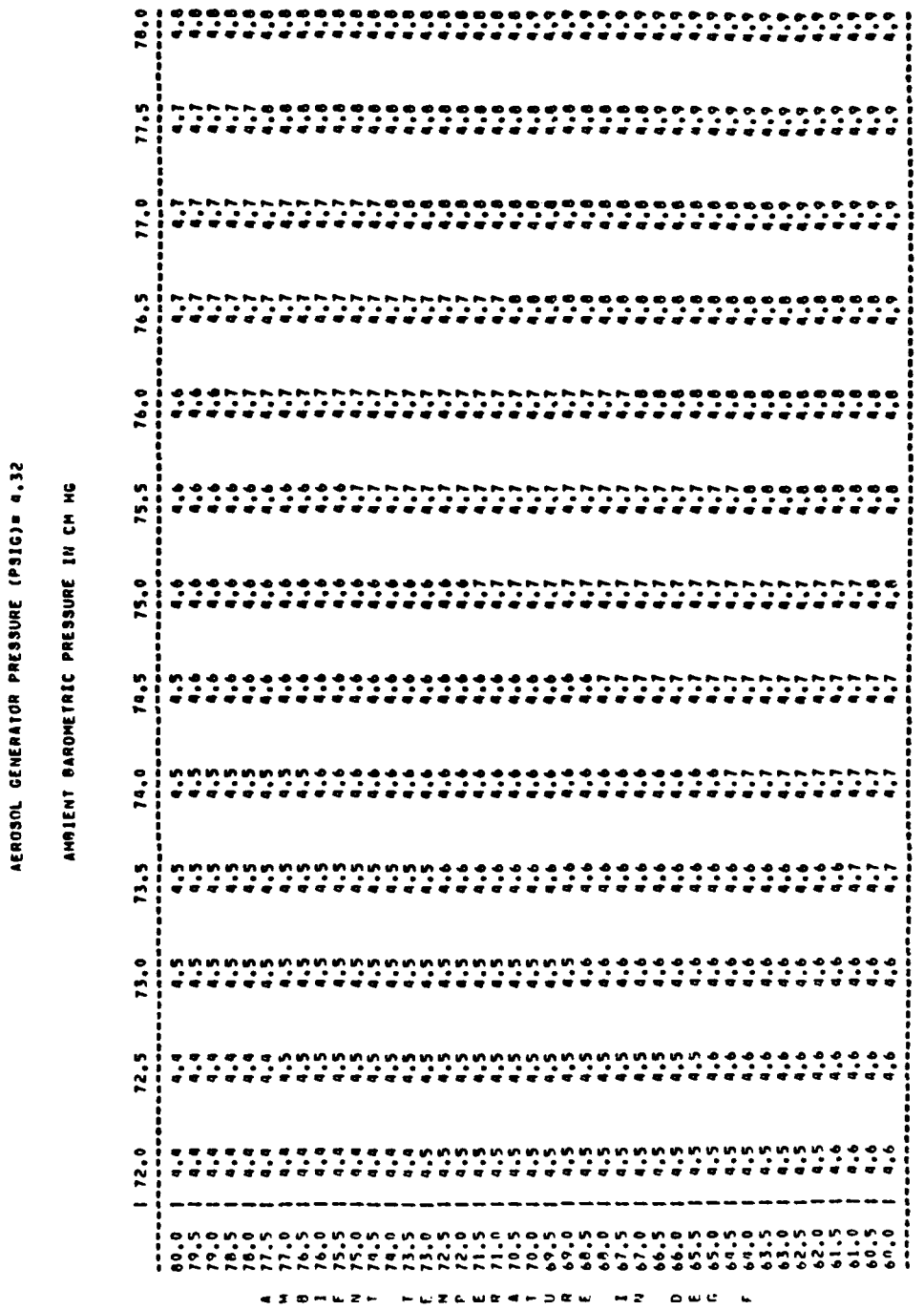
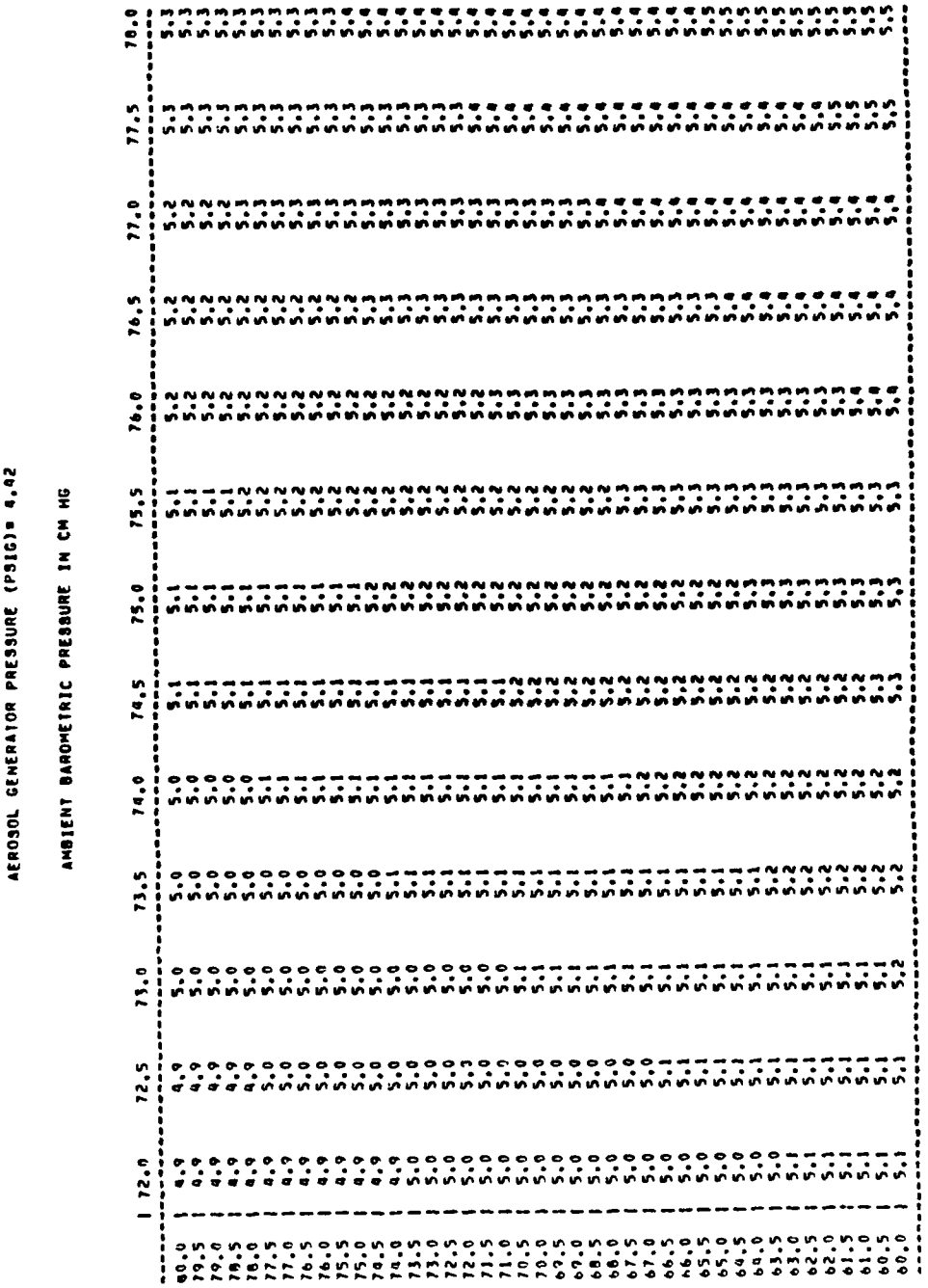
(Attachment A-1)



--APPENDIX A--
(Attachment A-1)



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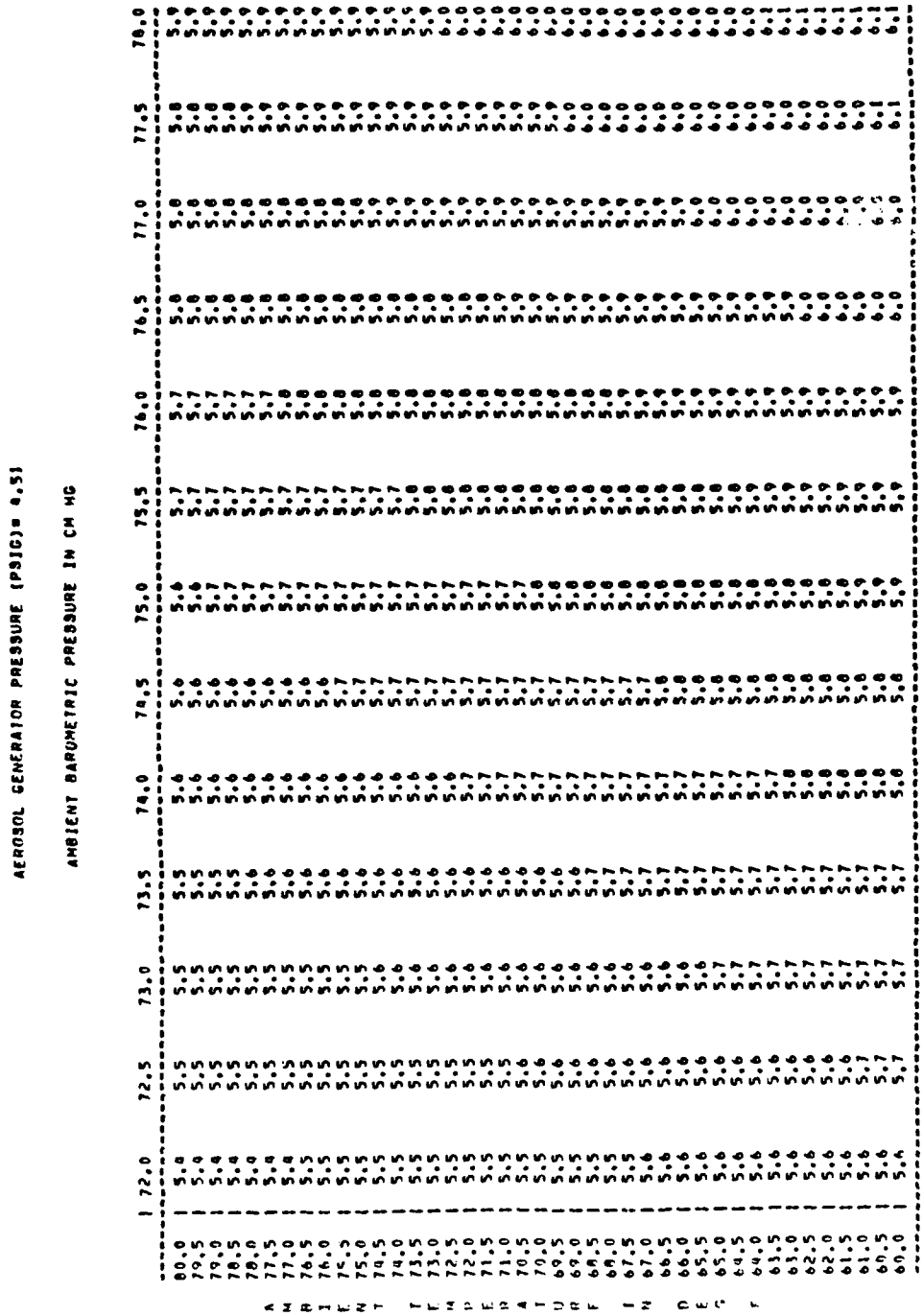
(Attachment A-1)



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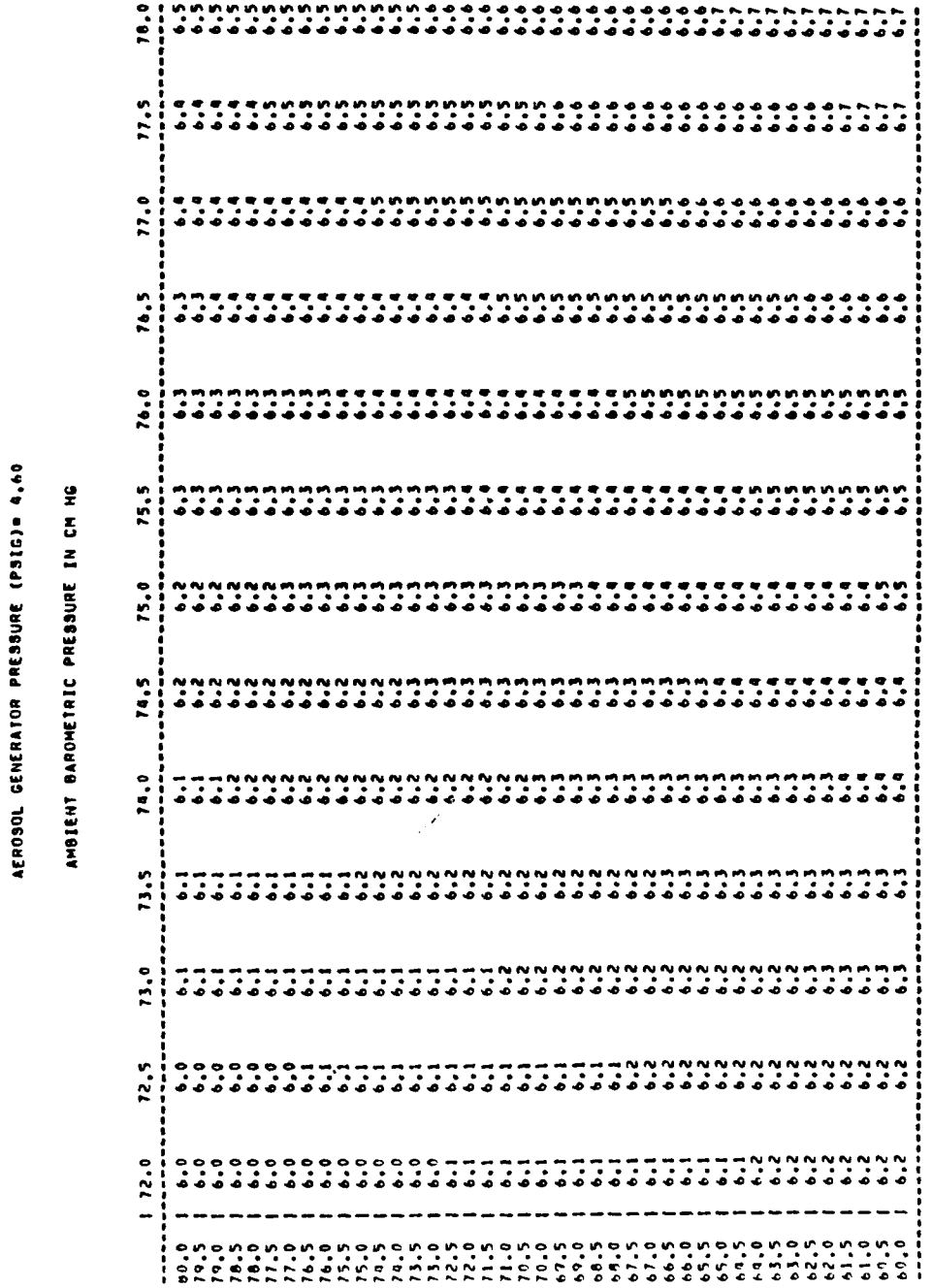
(Attachment A-1)



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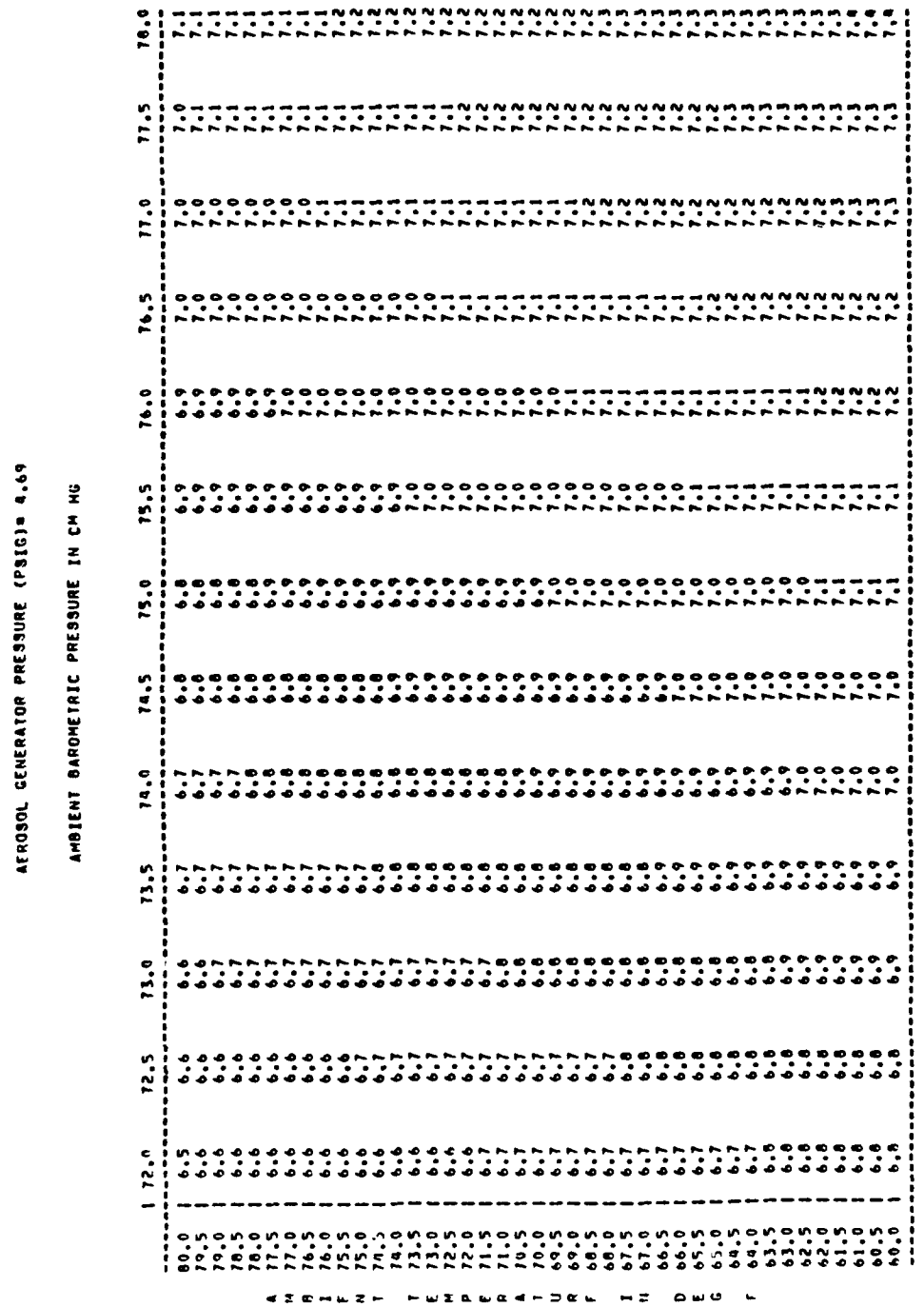
(Attachment A-1)



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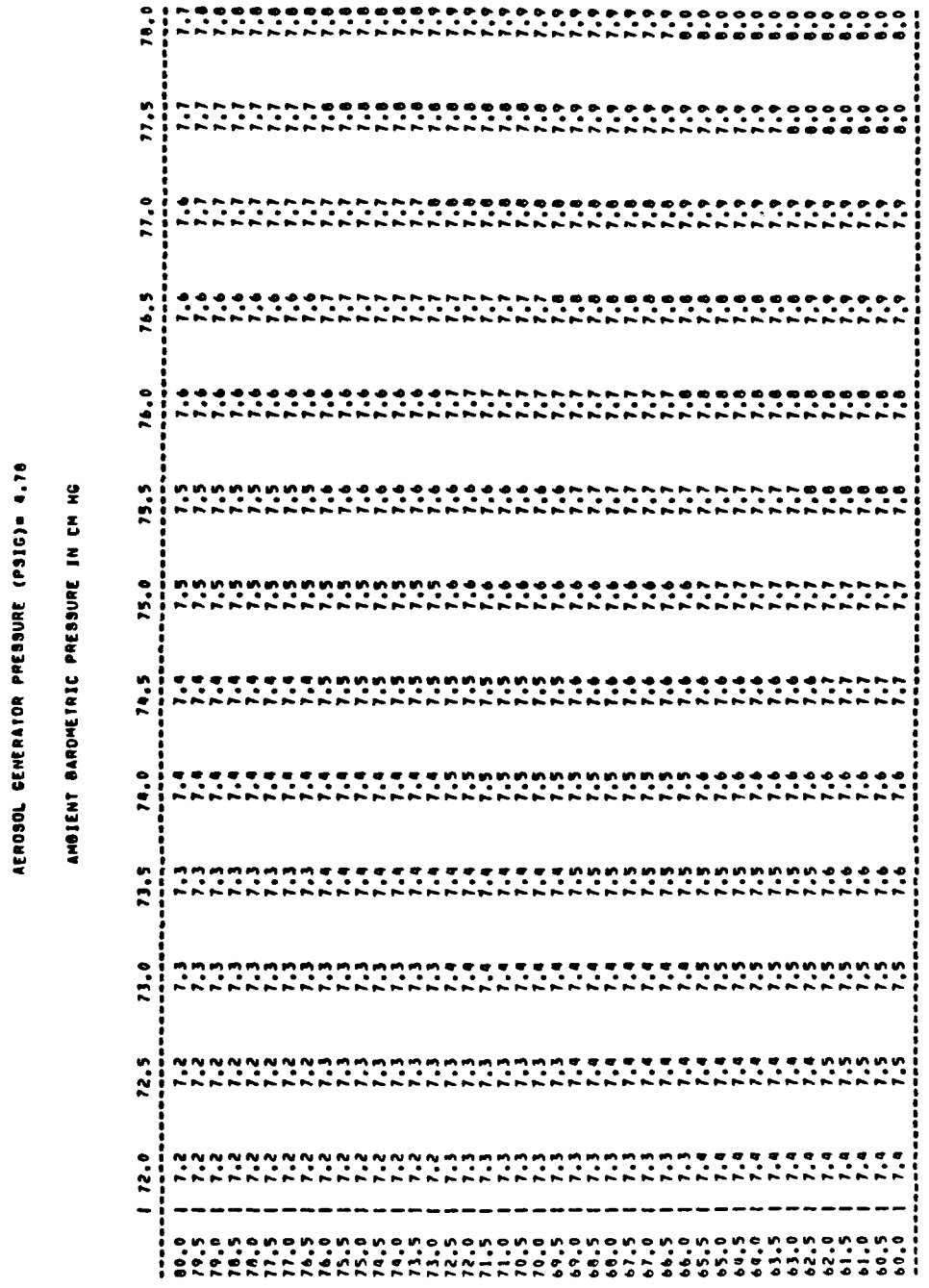
(Attachment A-1)



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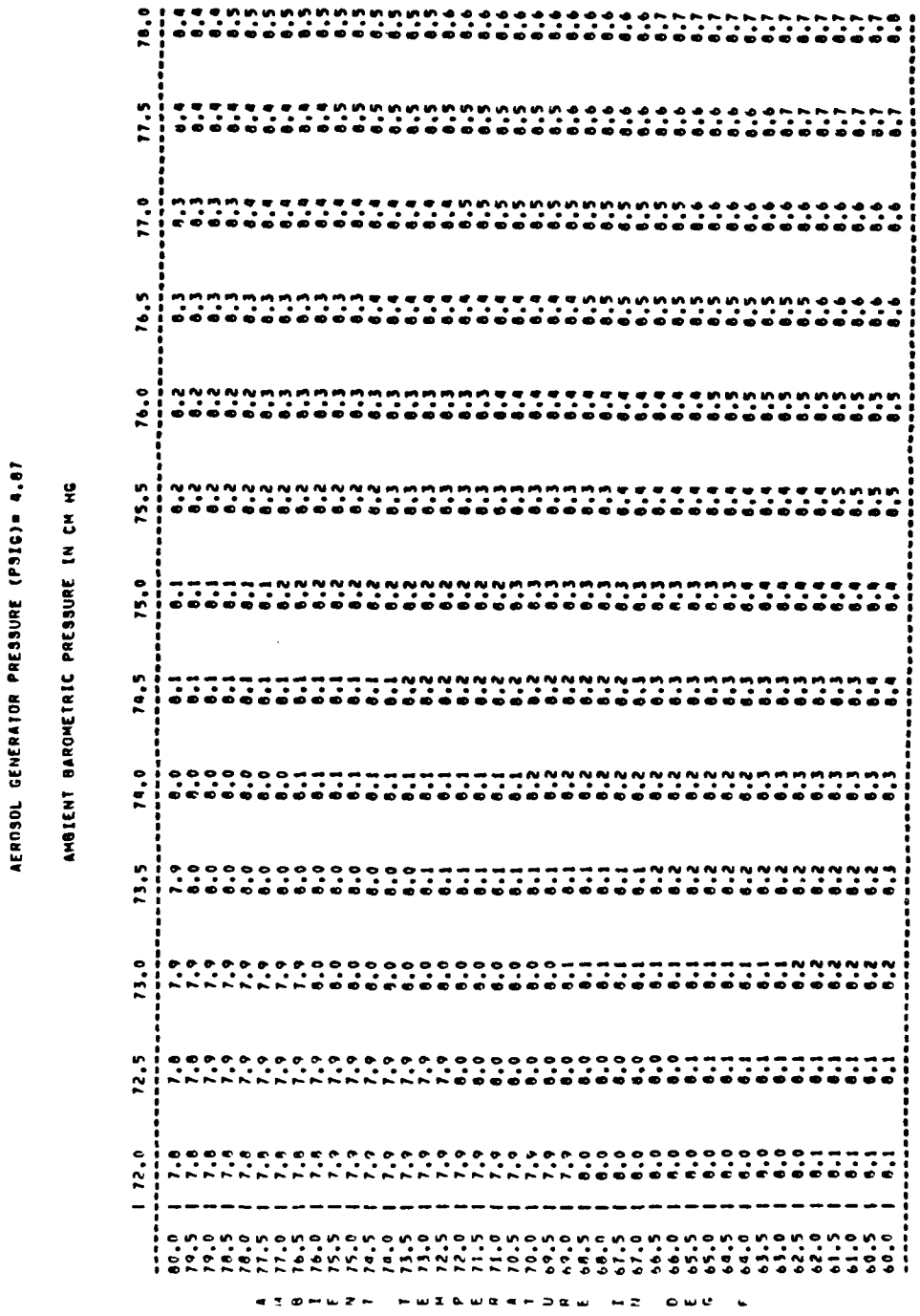
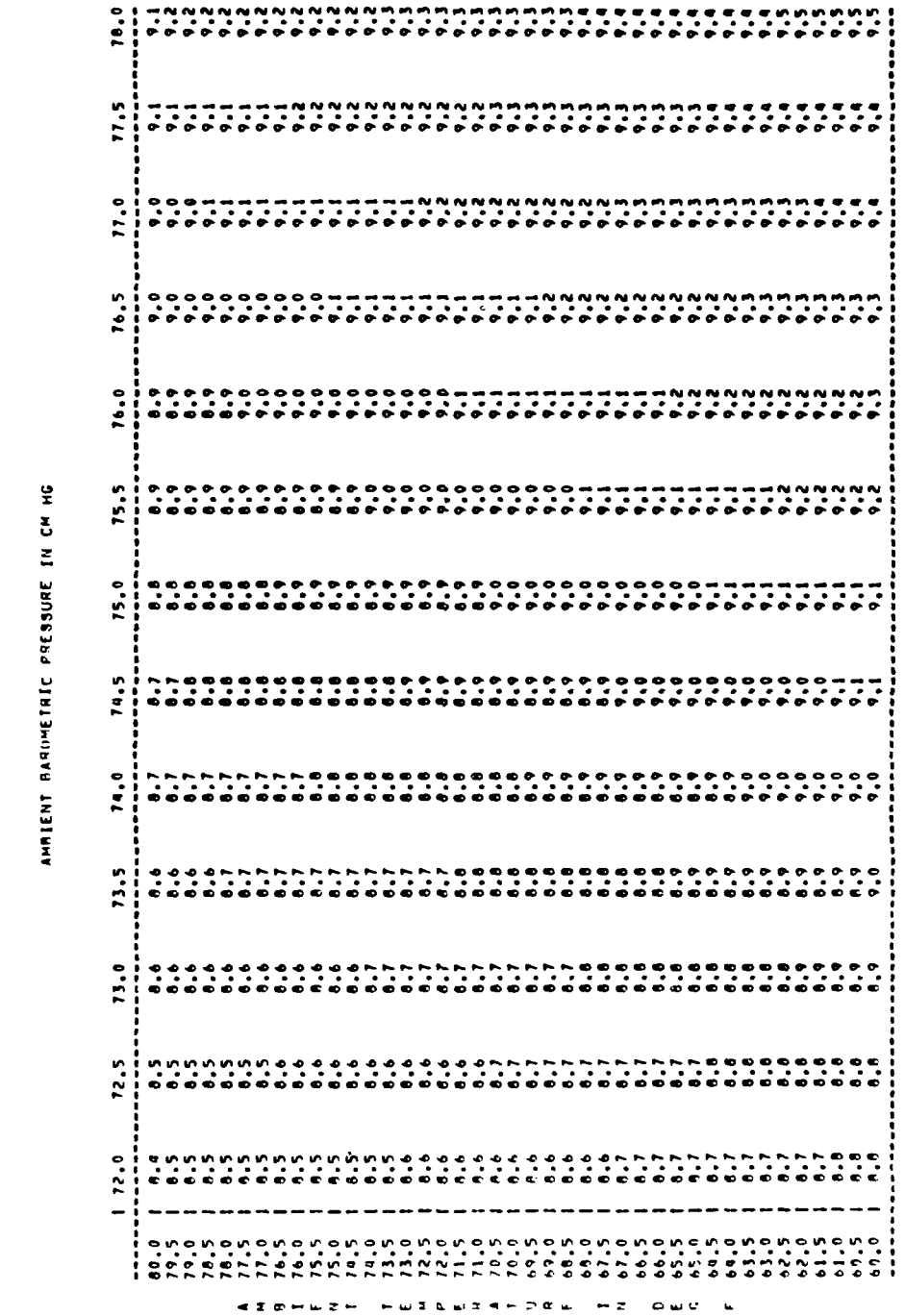
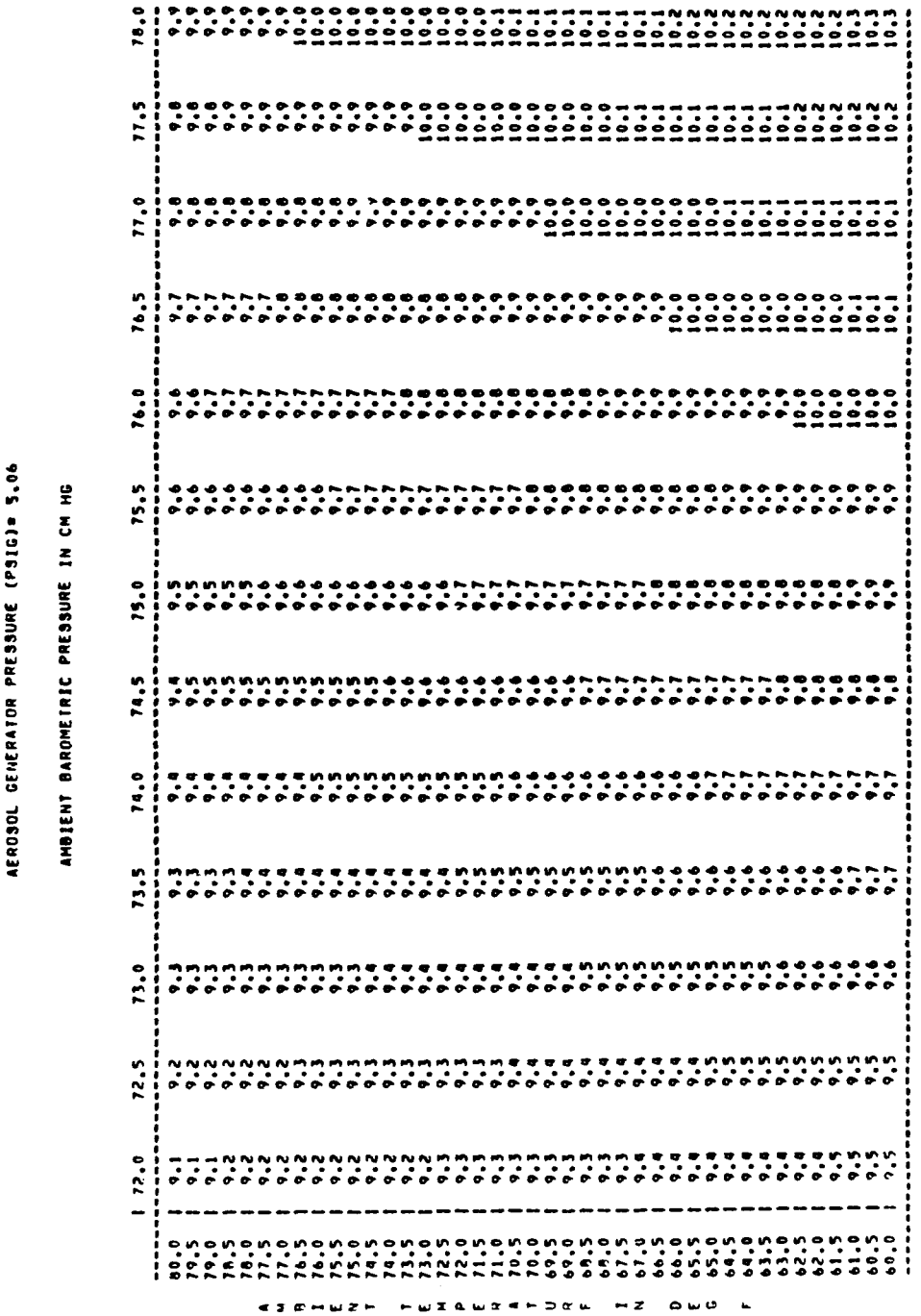
(Attachment A-1)



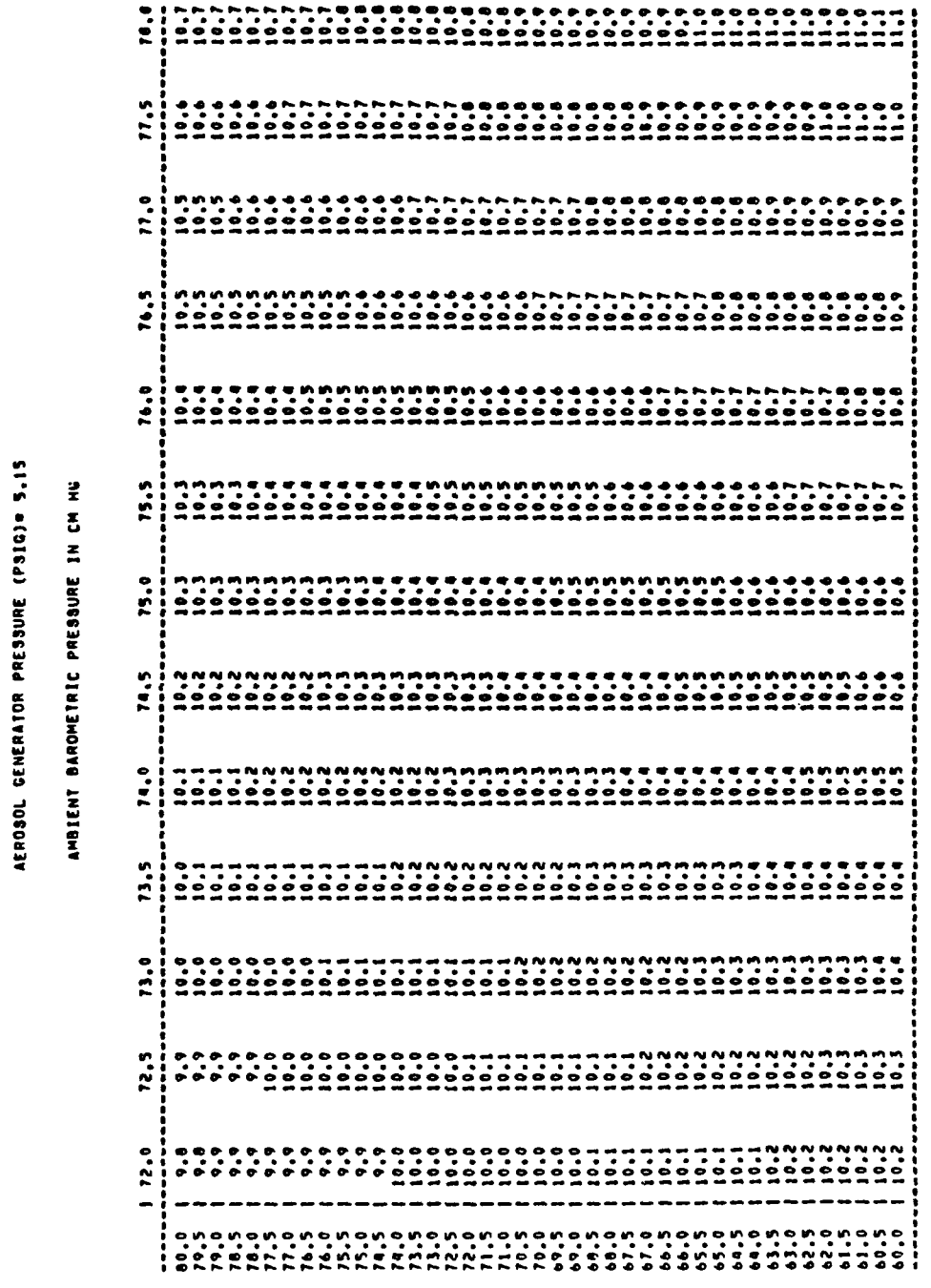
--APPENDIX A--
(Attachment A-1)



--APPENDIX A--
(Attachment A-1)



--APPENDIX A--
(Attachment A-1)



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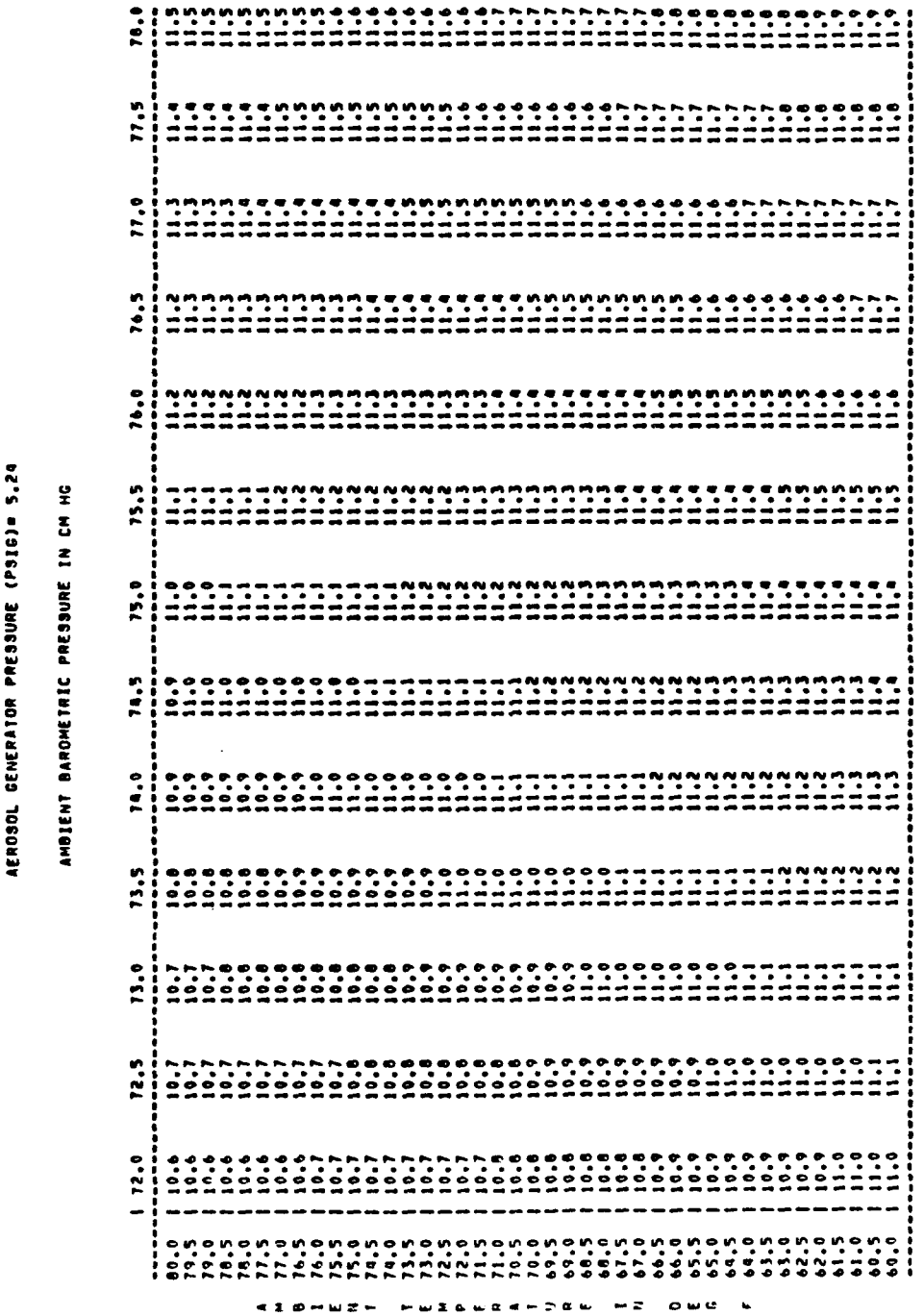
(Attachment A-1)



--APPENDIX A--
(Attachment A-1)

AEROSOL GENERATOR PRESSURE (PSIG)= 5.33

AMBIENT BAROMETRIC PRESSURE IN CM HG

AMBIENT TEMPERATURE IN DEG F	72.0	72.5	73.0	73.5	74.0	74.5	75.0	75.5	76.0	76.5	77.0	77.5	78.0
80.0	11.3	11.4	11.5	11.6	11.7	11.7	11.8	11.9	12.0	12.1	12.1	12.2	12.3
79.5	11.4	11.4	11.5	11.6	11.7	11.7	11.8	11.9	12.0	12.1	12.1	12.2	12.3
79.0	11.4	11.4	11.5	11.6	11.7	11.8	11.8	11.9	12.0	12.1	12.2	12.2	12.3
78.5	11.4	11.5	11.5	11.6	11.7	11.8	11.9	11.9	12.0	12.1	12.2	12.2	12.3
78.0	11.4	11.5	11.5	11.6	11.7	11.8	11.9	11.9	12.0	12.1	12.2	12.2	12.3
77.5	11.4	11.5	11.6	11.6	11.7	11.8	11.9	12.0	12.0	12.1	12.2	12.2	12.3
77.0	11.4	11.5	11.6	11.6	11.7	11.8	11.9	12.0	12.0	12.1	12.2	12.2	12.3
76.5	11.4	11.5	11.6	11.7	11.7	11.8	11.9	12.0	12.0	12.1	12.2	12.3	12.3
76.0	11.4	11.5	11.6	11.7	11.7	11.8	11.9	12.0	12.1	12.2	12.2	12.3	12.4
75.5	11.5	11.5	11.6	11.7	11.8	11.8	11.9	12.0	12.1	12.2	12.2	12.3	12.4
75.0	11.5	11.5	11.6	11.7	11.8	11.8	11.9	12.0	12.1	12.2	12.2	12.3	12.4
74.5	11.5	11.5	11.6	11.7	11.8	11.9	11.9	12.0	12.1	12.2	12.2	12.3	12.4
74.0	11.5	11.5	11.6	11.7	11.8	11.9	11.9	12.0	12.1	12.2	12.2	12.3	12.4
73.5	11.5	11.5	11.6	11.7	11.8	11.9	12.0	12.0	12.1	12.2	12.2	12.3	12.4
73.0	11.5	11.5	11.6	11.7	11.8	11.9	12.0	12.0	12.1	12.2	12.2	12.3	12.4
72.5	11.5	11.5	11.6	11.7	11.8	11.9	12.0	12.0	12.1	12.2	12.2	12.3	12.4
72.0	11.5	11.5	11.6	11.7	11.8	11.9	12.0	12.0	12.1	12.2	12.2	12.3	12.4
71.5	11.5	11.5	11.6	11.7	11.8	11.9	12.0	12.0	12.1	12.2	12.2	12.3	12.4
71.0	11.5	11.5	11.6	11.7	11.8	11.9	12.0	12.0	12.1	12.2	12.2	12.3	12.4
70.5	11.5	11.5	11.6	11.7	11.8	11.9	12.0	12.0	12.1	12.2	12.2	12.3	12.4
70.0	11.6	11.6	11.7	11.7	11.8	11.9	12.0	12.0	12.1	12.2	12.2	12.3	12.4
69.5	11.6	11.6	11.7	11.7	11.8	11.9	12.0	12.1	12.1	12.2	12.2	12.3	12.4
69.0	11.6	11.6	11.7	11.8	11.8	11.9	12.0	12.1	12.1	12.2	12.2	12.3	12.4
68.5	11.6	11.7	11.7	11.8	11.8	11.9	12.0	12.1	12.1	12.2	12.2	12.3	12.4
68.0	11.6	11.7	11.8	11.8	11.9	11.9	12.0	12.1	12.2	12.2	12.3	12.3	12.4
67.5	11.6	11.7	11.8	11.9	11.9	12.0	12.0	12.1	12.2	12.2	12.3	12.4	12.4
67.0	11.6	11.7	11.8	11.9	12.0	12.0	12.0	12.2	12.2	12.3	12.3	12.4	12.5
66.5	11.6	11.7	11.8	11.9	12.0	12.1	12.1	12.2	12.3	12.3	12.4	12.4	12.5
66.0	11.6	11.7	11.8	11.9	12.0	12.1	12.1	12.2	12.3	12.4	12.4	12.5	12.5
65.5	11.7	11.7	11.8	11.9	12.0	12.1	12.2	12.3	12.4	12.4	12.5	12.5	12.6
65.0	11.7	11.7	11.8	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.5	12.6	12.6
64.5	11.7	11.8	11.8	11.9	12.0	12.1	12.2	12.3	12.5	12.5	12.6	12.6	12.7
64.0	11.7	11.8	11.9	11.9	12.0	12.1	12.2	12.3	12.5	12.5	12.6	12.6	12.7
63.5	11.7	11.8	11.9	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.6	12.7
63.0	11.7	11.8	11.9	12.0	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.6	12.7
62.5	11.7	11.8	11.9	12.0	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.6	12.7
62.0	11.7	11.8	11.9	12.0	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.6	12.7
61.5	11.7	11.8	11.9	12.0	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.6	12.7
61.0	11.8	11.8	11.9	12.0	12.1	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.7
60.5	11.8	11.9	11.9	12.0	12.1	12.2	12.2	12.3	12.4	12.5	12.6	12.7	12.8
60.0	11.8	11.9	11.9	12.0	12.1	12.2	12.3	12.4	12.4	12.5	12.6	12.7	12.8

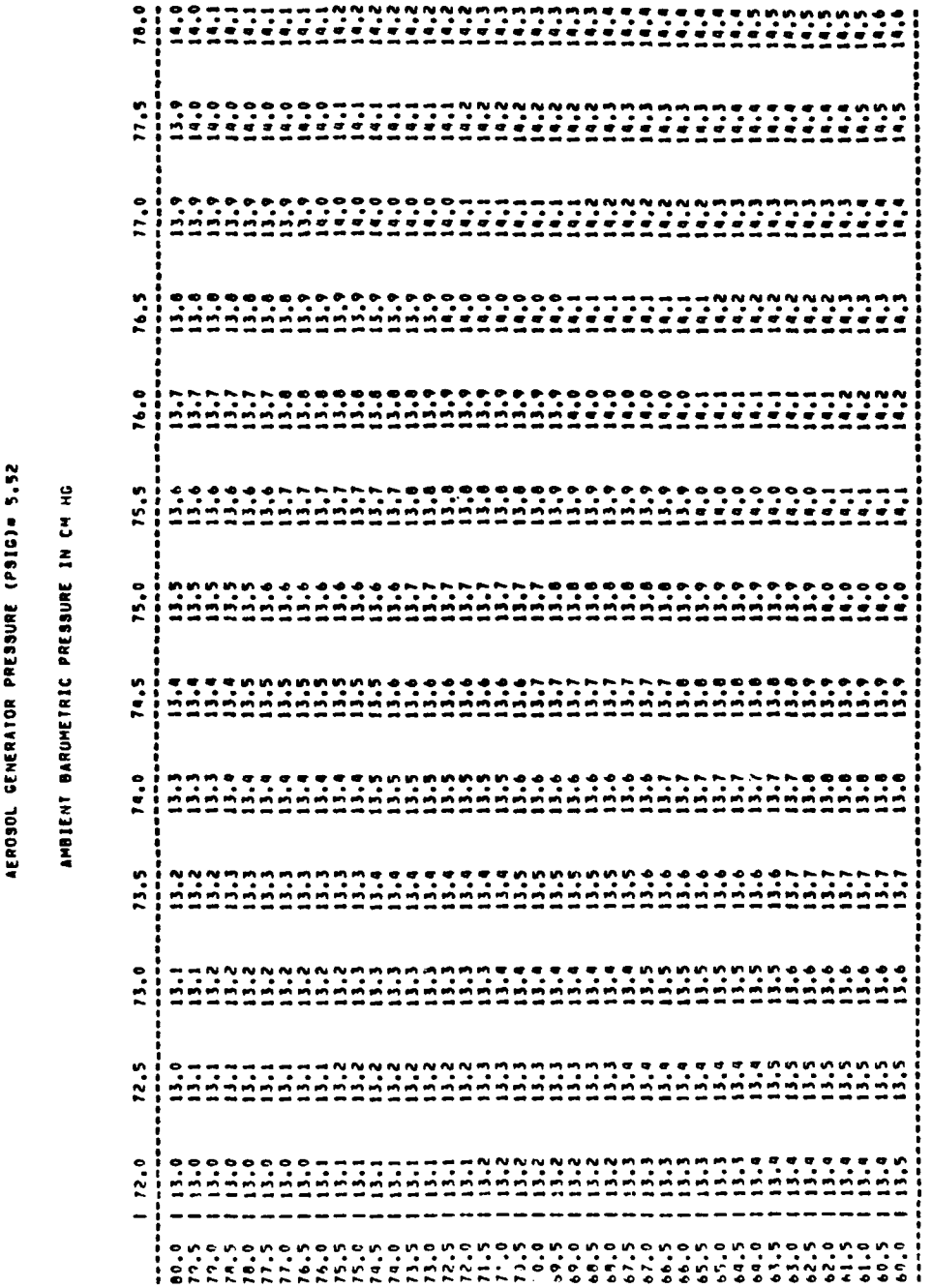
--APPENDIX A--
(Attachment A-1)

AEROSOL GENERATOR PRESSURE (PSIG)= 5.43

AMBIENT BAROMETRIC PRESSURE IN CM HG

AMBIENT TEMPERATURE (°F)	72.0	72.5	73.0	73.5	74.0	74.5	75.0	75.5	76.0	76.5	77.0	77.5	78.0
80.0	12.1	12.2	12.3	12.4	12.5	12.6	12.6	12.7	12.8	12.9	13.0	13.1	13.1
79.5	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.7	12.8	12.9	13.0	13.1	13.2
77.0	12.2	12.2	12.3	12.4	12.5	12.6	12.7	12.7	12.8	12.9	13.0	13.1	13.2
76.5	12.2	12.3	12.3	12.4	12.5	12.6	12.7	12.8	12.8	12.9	13.0	13.1	13.2
76.0	12.2	12.3	12.4	12.5	12.6	12.7	12.7	12.8	12.9	13.0	13.1	13.2	13.2
77.5	12.2	12.3	12.4	12.5	12.6	12.7	12.8	12.8	12.9	13.0	13.1	13.2	13.3
75.0	12.2	12.3	12.4	12.5	12.6	12.7	12.8	12.9	12.9	13.0	13.1	13.2	13.3
74.5	12.3	12.3	12.4	12.5	12.6	12.7	12.8	12.9	13.0	13.1	13.2	13.3	13.3
73.5	12.3	12.4	12.4	12.5	12.6	12.7	12.8	12.9	13.0	13.1	13.2	13.3	13.4
73.0	12.3	12.4	12.5	12.6	12.6	12.7	12.8	12.9	13.0	13.1	13.2	13.3	13.4
72.5	12.3	12.4	12.5	12.6	12.6	12.7	12.8	12.9	13.0	13.1	13.2	13.3	13.4
72.0	12.3	12.4	12.5	12.6	12.7	12.8	12.9	12.9	13.0	13.1	13.2	13.3	13.4
71.5	12.3	12.4	12.5	12.6	12.7	12.8	12.9	12.9	13.0	13.1	13.2	13.3	13.4
71.0	12.3	12.4	12.5	12.6	12.7	12.8	12.9	12.9	13.0	13.1	13.2	13.3	13.4
70.5	12.4	12.4	12.5	12.6	12.7	12.8	12.9	13.0	13.0	13.1	13.2	13.3	13.4
70.0	12.4	12.5	12.5	12.6	12.7	12.8	12.9	13.0	13.1	13.2	13.2	13.3	13.4
69.5	12.4	12.5	12.5	12.6	12.7	12.8	12.9	13.0	13.1	13.2	13.2	13.3	13.4
69.0	12.4	12.5	12.6	12.6	12.7	12.8	12.9	13.0	13.1	13.2	13.3	13.3	13.4
68.5	12.4	12.5	12.6	12.7	12.8	12.8	12.9	13.0	13.1	13.2	13.3	13.4	13.4
68.0	12.4	12.5	12.6	12.7	12.8	12.8	12.9	13.0	13.1	13.2	13.3	13.4	13.5
67.5	12.4	12.5	12.6	12.7	12.8	12.9	13.0	13.0	13.1	13.2	13.3	13.4	13.5
67.0	12.4	12.5	12.6	12.7	12.8	12.9	13.0	13.0	13.1	13.2	13.3	13.4	13.5
66.5	12.4	12.5	12.6	12.7	12.8	12.9	13.0	13.1	13.2	13.2	13.3	13.4	13.5
66.0	12.5	12.5	12.6	12.7	12.8	12.9	13.0	13.1	13.2	13.3	13.3	13.4	13.5
65.5	12.5	12.6	12.6	12.7	12.8	12.9	13.0	13.1	13.2	13.3	13.4	13.4	13.5
65.0	12.5	12.6	12.7	12.7	12.8	12.9	13.0	13.1	13.2	13.3	13.4	13.5	13.5
64.5	12.5	12.6	12.7	12.8	12.8	12.9	13.0	13.1	13.2	13.3	13.4	13.5	13.5
64.0	12.5	12.6	12.7	12.8	12.9	12.9	13.0	13.1	13.2	13.3	13.4	13.5	13.5
63.5	12.5	12.6	12.7	12.8	12.9	13.0	13.0	13.1	13.2	13.3	13.4	13.5	13.6
63.0	12.5	12.7	12.7	12.8	12.9	13.0	13.1	13.1	13.2	13.3	13.4	13.5	13.6
62.5	12.5	12.6	12.7	12.8	12.9	13.0	13.1	13.2	13.2	13.3	13.4	13.5	13.6
62.0	12.6	12.6	12.7	12.8	12.9	13.0	13.1	13.2	13.3	13.3	13.4	13.5	13.6
61.5	12.6	12.7	12.7	12.8	12.9	13.0	13.1	13.2	13.3	13.4	13.4	13.5	13.6
61.0	12.6	12.7	12.8	12.8	12.9	13.0	13.1	13.2	13.3	13.4	13.5	13.5	13.6
60.5	12.6	12.7	12.8	12.9	12.9	13.0	13.1	13.2	13.3	13.4	13.5	13.6	13.6
60.0	12.6	12.7	12.8	12.9	13.0	13.0	13.1	13.2	13.3	13.4	13.5	13.6	13.7

--APPENDIX A--
(Attachment A-1)



--APPENDIX A--
(Attachment A-1)

AEROSOL GENERATOR PRESSURE (PSIG)= 5.61

AMBIENT BAROMETRIC PRESSURE IN CM HG

AMBIENT TEMPERATURE IN DEG F	72.0	72.5	73.0	73.5	74.0	74.5	75.0	75.5	76.0	76.5	77.0	77.5	78.0
80.0	13.8	13.9	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0
79.5	13.8	13.9	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0
79.0	13.8	13.9	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0
78.5	13.8	13.9	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0
78.0	13.9	13.9	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0
77.5	13.9	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1
77.0	13.9	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1
76.5	13.9	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1
76.0	13.9	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1
75.5	13.9	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1
75.0	13.9	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1
74.5	13.9	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1
74.0	14.0	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1
73.5	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1	15.2
73.0	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1	15.2
72.5	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1	15.2
72.0	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1	15.2
71.5	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1	15.2
71.0	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1	15.2
70.5	14.1	14.2	14.3	14.4	14.5	14.5	14.6	14.7	14.8	14.9	15.0	15.1	15.2
70.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1	15.2	15.3
69.5	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1	15.2	15.3
69.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1	15.2	15.3
68.5	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1	15.2	15.3
68.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1	15.2	15.3
67.5	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1	15.2	15.3
67.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1	15.2	15.3
66.5	14.2	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1	15.2	15.3
66.0	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1	15.2	15.3	15.4
65.5	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1	15.2	15.3	15.4
65.0	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1	15.2	15.3	15.4
64.5	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1	15.2	15.3	15.4
64.0	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1	15.2	15.3	15.4
63.5	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1	15.2	15.3	15.4
63.0	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1	15.2	15.3	15.4
62.5	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1	15.2	15.3	15.4	15.5
62.0	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1	15.2	15.3	15.4	15.5
61.5	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1	15.2	15.3	15.4	15.5
61.0	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1	15.2	15.3	15.4	15.5
60.5	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1	15.2	15.3	15.4	15.5
60.0	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1	15.2	15.3	15.4	15.5

AEROSOL GENERATOR PRESSURE (PSIG)= 5.70

AMBIENT BAROMETRIC PRESSURE IN CM HG

AMBIENT TEMPERATURE IN DEG F	72.0	72.5	73.0	73.5	74.0	74.5	75.0	75.5	76.0	76.5	77.0	77.5	78.0
80.0	14.7	14.8	14.9	15.0	15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9
79.5	14.7	14.8	14.9	15.0	15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9
79.0	14.7	14.8	14.9	15.0	15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9
78.5	14.7	14.8	14.9	15.0	15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9
78.0	14.7	14.8	14.9	15.0	15.1	15.2	15.3	15.4	15.5	15.6	15.8	15.9	16.0
77.5	14.7	14.8	14.9	15.0	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9	16.0
77.0	14.8	14.9	15.0	15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9	16.0
76.5	14.8	14.9	15.0	15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9	16.0
76.0	14.8	14.9	15.0	15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9	16.0
75.5	14.8	14.9	15.0	15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9	16.0
75.0	14.8	14.9	15.0	15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9	16.0
74.5	14.8	14.9	15.0	15.1	15.2	15.3	15.4	15.5	15.6	15.8	15.9	16.0	16.1
74.0	14.8	14.9	15.0	15.1	15.2	15.4	15.5	15.6	15.7	15.8	15.9	16.0	16.1
73.5	14.9	15.0	15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9	16.0	16.1
73.0	14.9	15.0	15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9	16.0	16.1
72.5	14.9	15.0	15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9	16.0	16.1
72.0	14.9	15.0	15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9	16.0	16.1
71.5	14.9	15.0	15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9	16.0	16.1
71.0	14.9	15.0	15.1	15.2	15.3	15.4	15.5	15.6	15.8	15.9	16.0	16.1	16.2
70.5	14.9	15.0	15.1	15.2	15.4	15.5	15.6	15.7	15.8	15.9	16.0	16.1	16.2
70.0	14.9	15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9	16.0	16.1	16.2
69.5	15.0	15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9	16.0	16.1	16.2
69.0	15.0	15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9	16.0	16.1	16.2
68.5	15.0	15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9	16.0	16.1	16.2
68.0	15.0	15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9	16.0	16.2	16.3
67.5	15.0	15.1	15.2	15.3	15.4	15.5	15.6	15.8	15.9	16.0	16.1	16.2	16.3
67.0	15.0	15.1	15.2	15.3	15.5	15.6	15.7	15.8	15.9	16.0	16.1	16.2	16.3
66.5	15.0	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9	16.0	16.1	16.2	16.3
66.0	15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9	16.0	16.1	16.2	16.3
65.5	15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9	16.0	16.1	16.2	16.3
65.0	15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9	16.0	16.1	16.2	16.3
64.5	15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9	16.1	16.2	16.3	16.4
64.0	15.1	15.2	15.3	15.4	15.5	15.6	15.8	15.9	16.0	16.1	16.2	16.3	16.4
63.5	15.1	15.2	15.3	15.5	15.6	15.7	15.8	15.9	16.0	16.1	16.2	16.3	16.4
63.0	15.1	15.3	15.4	15.5	15.6	15.7	15.8	15.9	16.0	16.1	16.2	16.3	16.4
62.5	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9	16.0	16.1	16.2	16.3	16.4
62.0	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9	16.0	16.1	16.2	16.3	16.4
61.5	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9	16.0	16.1	16.2	16.4	16.5
61.0	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9	16.1	16.2	16.3	16.4	16.5
60.5	15.2	15.3	15.4	15.5	15.6	15.8	15.9	16.0	16.1	16.2	16.3	16.4	16.5
60.0	15.2	15.3	15.4	15.6	15.7	15.8	15.9	16.0	16.1	16.2	16.3	16.4	16.5

--APPENDIX A--
(Attachment A-1)

AEROSOL GENERATOR PRESSURE (PSIG)= 5.79

AMBIENT BAROMETRIC PRESSURE IN CM HG

A	80.0	16.9	16.8	16.7	16.6	16.5	16.4	16.3	16.2	16.1	16.0	15.9	15.8	15.7	15.6
	79.5	16.9	16.8	16.7	16.6	16.5	16.4	16.3	16.2	16.1	16.0	15.9	15.8	15.7	15.6
	79.0	16.9	16.8	16.7	16.6	16.5	16.4	16.3	16.2	16.1	16.0	15.9	15.8	15.7	15.6
	78.5	16.9	16.8	16.7	16.6	16.5	16.4	16.3	16.2	16.1	16.0	15.9	15.8	15.7	15.6
	78.0	16.9	16.8	16.7	16.6	16.5	16.4	16.3	16.2	16.1	16.0	15.9	15.8	15.7	15.6
	77.5	17.0	16.9	16.8	16.7	16.6	16.5	16.4	16.3	16.2	16.1	16.0	15.9	15.8	15.7
	77.0	17.0	16.9	16.8	16.7	16.6	16.5	16.4	16.3	16.2	16.1	16.0	15.9	15.8	15.7
	76.5	17.0	16.9	16.8	16.7	16.6	16.5	16.4	16.3	16.2	16.1	16.0	15.9	15.8	15.7
	76.0	17.1	17.0	16.9	16.8	16.7	16.6	16.5	16.4	16.3	16.2	16.1	16.0	15.9	15.8
	75.5	17.1	17.0	16.9	16.8	16.7	16.6	16.5	16.4	16.3	16.2	16.1	16.0	15.9	15.8
	75.0	17.2	17.1	17.0	16.9	16.8	16.7	16.6	16.5	16.4	16.3	16.2	16.1	16.0	15.9
	74.5	17.2	17.1	17.0	16.9	16.8	16.7	16.6	16.5	16.4	16.3	16.2	16.1	16.0	15.9
	74.0	17.3	17.2	17.1	17.0	16.9	16.8	16.7	16.6	16.5	16.4	16.3	16.2	16.1	16.0
	73.5	17.3	17.2	17.1	17.0	16.9	16.8	16.7	16.6	16.5	16.4	16.3	16.2	16.1	16.0
	73.0	17.4	17.3	17.2	17.1	17.0	16.9	16.8	16.7	16.6	16.5	16.4	16.3	16.2	16.1
	72.5	17.5	17.4	17.3	17.2	17.1	17.0	16.9	16.8	16.7	16.6	16.5	16.4	16.3	16.2
	72.0	17.5	17.5	17.4	17.3	17.2	17.1	17.0	16.9	16.8	16.7	16.6	16.5	16.4	16.3

--APPENDIX A--
(Attachment A-1)

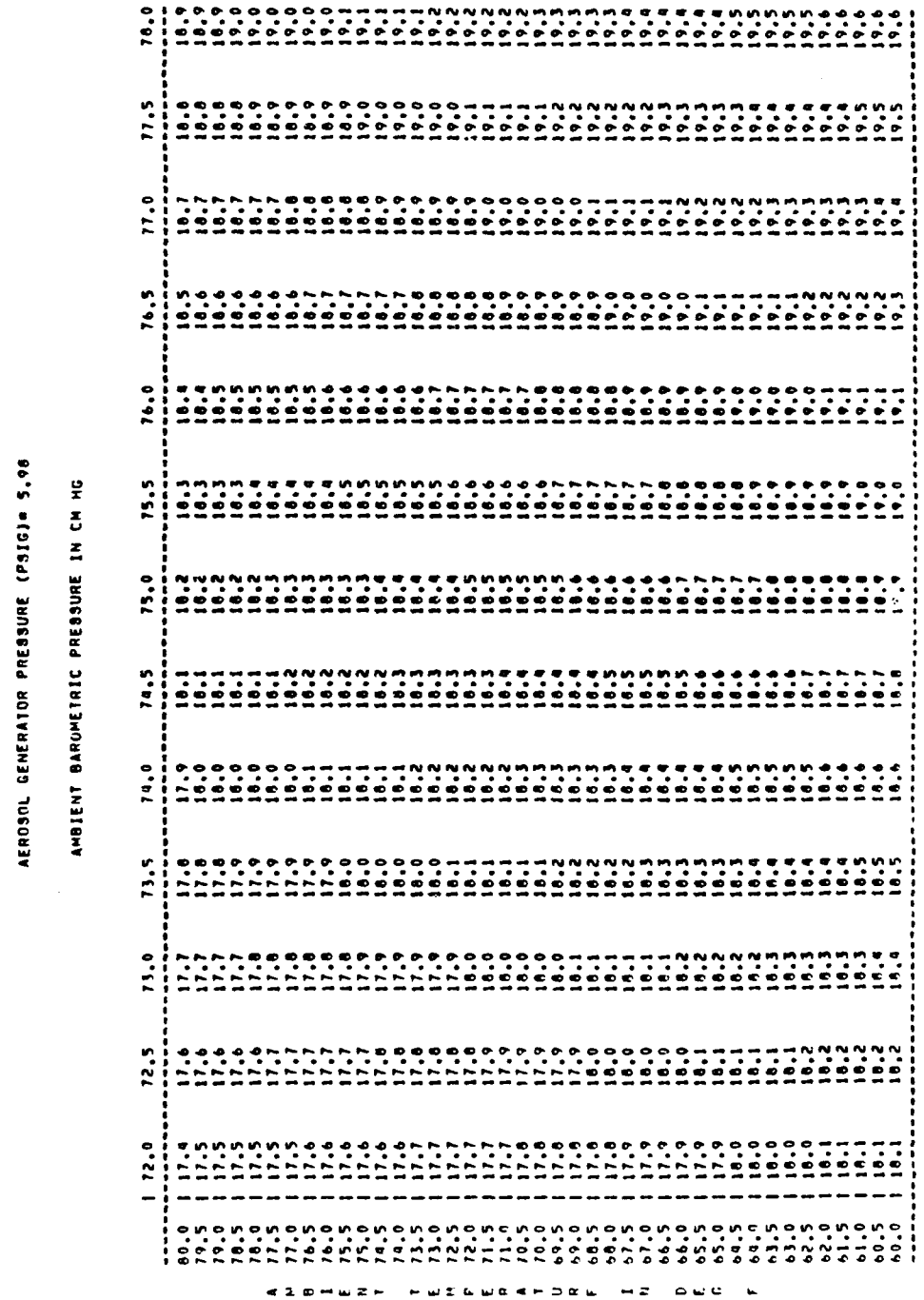
AEROSOL GENERATOR PRESSURE (PSIG)= 5.88

AMBIENT BAROMETRIC PRESSURE IN CM HG

I	72.0	72.5	73.0	73.5	74.0	74.5	75.0	75.5	76.0	76.5	77.0	77.5	78.0
80.0	16.5	16.6	16.7	16.8	17.0	17.1	17.2	17.3	17.4	17.5	17.6	17.8	17.9
79.5	16.5	16.6	16.7	16.9	17.0	17.1	17.2	17.3	17.4	17.5	17.7	17.8	17.9
79.0	16.5	16.6	16.8	16.9	17.0	17.1	17.2	17.3	17.4	17.6	17.7	17.8	17.9
78.5	16.5	16.7	16.8	16.9	17.0	17.1	17.2	17.3	17.5	17.6	17.7	17.8	17.9
78.0	16.6	16.7	16.8	16.9	17.0	17.1	17.2	17.4	17.5	17.6	17.7	17.8	18.0
77.5	16.6	16.7	16.8	16.9	17.0	17.1	17.3	17.4	17.5	17.6	17.7	17.9	18.0
77.0	16.6	16.7	16.8	16.9	17.1	17.2	17.3	17.4	17.5	17.6	17.7	17.9	18.0
76.5	16.6	16.7	16.8	17.0	17.1	17.2	17.3	17.4	17.5	17.7	17.8	17.9	18.0
76.0	16.6	16.7	16.9	17.0	17.1	17.2	17.3	17.4	17.5	17.7	17.8	17.9	18.0
75.5	16.6	16.8	16.9	17.0	17.1	17.2	17.3	17.4	17.6	17.8	17.9	18.0	18.1
75.0	16.7	16.8	16.9	17.0	17.1	17.2	17.4	17.5	17.6	17.8	17.9	18.0	18.1
74.5	16.7	16.8	16.9	17.0	17.1	17.2	17.4	17.5	17.6	17.8	17.9	18.0	18.1
74.0	16.7	16.8	16.9	17.0	17.1	17.3	17.4	17.5	17.7	17.8	17.9	18.0	18.1
73.5	16.7	16.8	16.9	17.0	17.2	17.3	17.4	17.5	17.7	17.8	17.9	18.0	18.2
73.0	16.7	16.8	16.9	17.1	17.2	17.3	17.4	17.5	17.7	17.8	17.9	18.0	18.2
72.5	16.7	16.8	16.9	17.1	17.2	17.3	17.4	17.5	17.7	17.8	17.9	18.0	18.2
72.0	16.7	16.8	16.9	17.1	17.2	17.3	17.4	17.5	17.7	17.8	17.9	18.0	18.2
71.5	16.8	16.9	17.0	17.1	17.2	17.3	17.5	17.6	17.7	17.8	17.9	18.1	18.3
71.0	16.8	16.9	17.0	17.1	17.2	17.4	17.5	17.6	17.7	17.8	17.9	18.1	18.3
70.5	16.8	16.9	17.0	17.1	17.3	17.4	17.5	17.6	17.7	17.8	17.9	18.1	18.3
70.0	16.8	16.9	17.0	17.2	17.3	17.4	17.5	17.6	17.7	17.8	17.9	18.1	18.3
69.5	16.8	16.9	17.1	17.2	17.3	17.4	17.5	17.6	17.7	17.8	17.9	18.1	18.3
69.0	16.8	17.0	17.1	17.2	17.3	17.4	17.6	17.6	17.7	17.8	17.9	18.1	18.3
68.5	16.9	17.0	17.1	17.2	17.3	17.4	17.6	17.7	17.7	17.8	17.9	18.1	18.3
68.0	16.9	17.0	17.1	17.2	17.3	17.5	17.5	17.6	17.7	17.8	17.9	18.1	18.3
67.5	16.9	17.0	17.1	17.2	17.4	17.5	17.5	17.6	17.7	17.8	17.9	18.1	18.3
67.0	16.9	17.0	17.1	17.3	17.4	17.5	17.5	17.6	17.7	17.8	17.9	18.1	18.3
66.5	16.9	17.0	17.2	17.3	17.4	17.5	17.5	17.6	17.7	17.8	17.9	18.1	18.3
66.0	16.9	17.1	17.2	17.3	17.4	17.5	17.5	17.6	17.7	17.8	17.9	18.1	18.3
65.5	17.0	17.1	17.2	17.3	17.4	17.5	17.6	17.7	17.7	17.8	17.9	18.1	18.4
65.0	17.0	17.1	17.2	17.3	17.5	17.6	17.6	17.7	17.8	17.9	18.0	18.2	18.4
64.5	17.0	17.1	17.2	17.3	17.5	17.6	17.7	17.7	17.8	17.9	18.0	18.2	18.4
64.0	17.0	17.1	17.2	17.4	17.5	17.6	17.7	17.7	17.8	17.9	18.0	18.2	18.4
63.5	17.0	17.1	17.3	17.4	17.5	17.6	17.7	17.8	17.8	17.9	18.0	18.2	18.4
63.0	17.0	17.2	17.3	17.4	17.5	17.6	17.7	17.8	17.8	17.9	18.0	18.2	18.4
62.5	17.1	17.2	17.3	17.4	17.5	17.6	17.7	17.8	17.8	17.9	18.0	18.2	18.4
62.0	17.1	17.2	17.3	17.4	17.5	17.6	17.7	17.8	17.8	17.9	18.0	18.2	18.4
61.5	17.1	17.2	17.3	17.4	17.6	17.6	17.7	17.8	17.8	17.9	18.0	18.2	18.4
61.0	17.1	17.2	17.3	17.5	17.6	17.6	17.7	17.8	17.8	17.9	18.0	18.2	18.4
60.5	17.1	17.2	17.4	17.5	17.6	17.6	17.7	17.8	17.8	17.9	18.0	18.2	18.4
60.0	17.1	17.3	17.4	17.5	17.6	17.6	17.7	17.8	18.0	18.1	18.0	18.2	18.4

A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
P

--APPENDIX A--
(Attachment A-1)



AEROSOL GENERATOR PRESSURE (PSIG)= 6.07

AMBIENT BAROMETRIC PRESSURE IN CM HG

	72.0	72.5	73.0	73.5	74.0	74.5	75.0	75.5	76.0	76.5	77.0	77.5	78.0
	80.0	18.4	18.7	18.8	18.9	19.1	19.2	19.3	19.5	19.6	19.7	19.8	20.0
	79.5	18.4	18.7	18.8	19.0	19.1	19.2	19.3	19.5	19.6	19.7	19.9	20.0
	79.0	18.5	18.7	18.8	19.0	19.1	19.2	19.4	19.5	19.6	19.7	19.9	20.0
	78.5	18.5	18.7	18.9	19.0	19.1	19.3	19.4	19.5	19.6	19.8	19.9	20.0
	78.0	18.5	18.8	18.9	19.0	19.1	19.3	19.4	19.5	19.7	19.8	19.9	20.1
A	77.5	18.5	18.8	18.9	19.0	19.2	19.3	19.4	19.5	19.7	19.8	19.9	20.1
M	77.0	18.5	18.8	18.9	19.0	19.2	19.3	19.4	19.6	19.7	19.8	19.9	20.1
B	76.5	18.5	18.8	18.9	19.1	19.2	19.3	19.5	19.6	19.7	19.8	20.0	20.1
I	76.0	18.6	18.8	19.0	19.1	19.2	19.3	19.5	19.6	19.7	19.9	20.0	20.1
E	75.5	18.6	18.8	19.0	19.1	19.2	19.4	19.5	19.6	19.7	19.9	20.0	20.1
N	75.0	18.6	18.9	19.0	19.1	19.2	19.4	19.5	19.6	19.8	19.9	20.0	20.2
T	74.5	18.6	18.9	19.0	19.1	19.3	19.4	19.5	19.7	19.8	19.9	20.0	20.2
	74.0	18.6	18.9	19.0	19.2	19.3	19.4	19.5	19.7	19.8	19.9	20.1	20.2
T	73.5	18.7	18.9	19.0	19.2	19.3	19.4	19.6	19.7	19.8	19.9	20.1	20.2
E	73.0	18.7	18.9	19.1	19.2	19.3	19.4	19.6	19.7	19.9	20.0	20.1	20.2
M	72.5	18.7	18.9	19.1	19.2	19.3	19.5	19.6	19.7	19.9	20.0	20.1	20.3
P	72.0	18.7	19.0	19.1	19.2	19.4	19.5	19.6	19.7	19.9	20.0	20.1	20.3
E	71.5	18.7	19.0	19.1	19.2	19.4	19.5	19.6	19.8	19.9	20.0	20.2	20.3
R	71.0	18.7	19.0	19.1	19.3	19.4	19.5	19.7	19.8	19.9	20.0	20.2	20.3
A	70.5	18.8	18.9	19.1	19.3	19.4	19.5	19.7	19.8	19.9	20.1	20.2	20.3
T	70.0	18.8	19.0	19.2	19.3	19.4	19.6	19.7	19.8	20.0	20.1	20.2	20.4
U	69.5	18.8	19.0	19.1	19.3	19.4	19.6	19.7	19.8	20.0	20.1	20.2	20.4
R	69.0	18.8	18.9	19.2	19.3	19.5	19.6	19.7	19.9	20.0	20.1	20.2	20.4
E	68.5	18.8	19.0	19.1	19.4	19.5	19.6	19.7	19.9	20.0	20.1	20.3	20.4
	68.0	18.8	19.0	19.1	19.4	19.5	19.6	19.8	19.9	20.0	20.2	20.3	20.4
I	67.5	18.9	19.0	19.1	19.3	19.5	19.7	19.8	19.9	20.0	20.2	20.3	20.5
N	67.0	18.9	19.0	19.1	19.4	19.5	19.7	19.8	19.9	20.1	20.2	20.3	20.5
	66.5	18.9	19.0	19.2	19.3	19.6	19.7	19.8	20.0	20.1	20.2	20.3	20.5
D	66.0	18.9	19.1	19.2	19.4	19.6	19.7	19.8	20.0	20.1	20.2	20.4	20.5
E	65.5	18.9	19.1	19.2	19.3	19.6	19.7	19.9	20.0	20.1	20.3	20.4	20.5
G	65.0	19.0	19.1	19.2	19.4	19.5	19.7	19.9	20.0	20.1	20.3	20.4	20.5
	64.5	19.0	19.1	19.2	19.4	19.6	19.8	19.9	20.0	20.2	20.3	20.4	20.6
F	64.0	19.0	19.1	19.3	19.4	19.5	19.8	19.9	20.0	20.2	20.3	20.4	20.6
	63.5	19.0	19.1	19.3	19.4	19.5	19.8	19.9	20.1	20.2	20.3	20.5	20.6
	63.0	19.0	19.2	19.3	19.4	19.6	19.8	20.0	20.1	20.2	20.3	20.5	20.6
	62.5	19.0	19.2	19.3	19.4	19.7	19.8	20.0	20.1	20.2	20.4	20.5	20.6
	62.0	19.1	19.2	19.3	19.5	19.6	19.8	20.0	20.1	20.3	20.4	20.5	20.7
	61.5	19.1	19.2	19.3	19.5	19.6	19.7	19.9	20.0	20.3	20.4	20.5	20.7
	61.0	19.1	19.2	19.3	19.5	19.6	19.7	19.9	20.0	20.3	20.4	20.5	20.7
	60.5	19.1	19.3	19.4	19.5	19.7	19.8	19.9	20.0	20.3	20.4	20.6	20.7
	60.0	19.1	19.3	19.4	19.5	19.7	19.8	19.9	20.1	20.3	20.5	20.6	20.7

--APPENDIX A--
(Attachment A-1)

AEROSOL GENERATOR PRESSURE (PSIG)= 6.16

AMBIENT BAROMETRIC PRESSURE IN CM HG

TEMPERATURE DEG F	72.0	72.5	73.0	73.5	74.0	74.5	75.0	75.5	76.0	76.5	77.0	77.5	78.0
80.0	19.4	19.6	19.7	19.8	20.0	20.1	20.2	20.4	20.5	20.6	20.8	20.9	21.1
79.5	19.5	19.6	19.7	19.9	20.0	20.1	20.3	20.4	20.5	20.7	20.8	20.9	21.1
79.0	19.5	19.6	19.7	19.9	20.0	20.1	20.3	20.4	20.6	20.7	20.8	21.0	21.1
78.5	19.5	19.6	19.8	19.9	20.0	20.2	20.3	20.4	20.6	20.7	20.8	21.0	21.1
78.0	19.5	19.6	19.8	19.9	20.1	20.2	20.3	20.5	20.6	20.7	20.9	21.0	21.2
77.5	19.5	19.7	19.8	20.0	20.1	20.2	20.4	20.5	20.6	20.8	20.9	21.0	21.2
77.0	19.5	19.7	19.8	20.0	20.1	20.2	20.4	20.5	20.6	20.8	20.9	21.1	21.2
76.5	19.6	19.7	19.9	20.0	20.1	20.2	20.4	20.5	20.7	20.8	20.9	21.1	21.2
76.0	19.6	19.7	19.9	20.0	20.1	20.3	20.4	20.6	20.7	20.8	21.0	21.1	21.3
75.5	19.6	19.7	19.9	20.0	20.2	20.3	20.4	20.6	20.7	20.8	21.0	21.1	21.3
75.0	19.6	19.8	19.9	20.0	20.2	20.3	20.5	20.6	20.8	20.9	21.0	21.2	21.3
74.5	19.6	19.8	19.9	20.1	20.2	20.3	20.5	20.6	20.8	20.9	21.0	21.2	21.3
74.0	19.7	19.8	19.9	20.1	20.2	20.4	20.5	20.7	20.8	20.9	21.0	21.2	21.4
73.5	19.7	19.8	20.0	20.1	20.2	20.4	20.5	20.7	20.9	21.0	21.1	21.2	21.4
73.0	19.7	19.9	20.0	20.1	20.2	20.4	20.5	20.7	20.9	21.0	21.1	21.3	21.4
72.5	19.7	19.9	20.0	20.1	20.3	20.4	20.5	20.7	20.9	21.0	21.1	21.3	21.4
72.0	19.7	19.9	20.0	20.1	20.3	20.4	20.5	20.7	20.9	21.0	21.1	21.3	21.4
71.5	19.7	19.9	20.0	20.2	20.3	20.4	20.6	20.7	20.9	21.0	21.2	21.3	21.4
71.0	19.8	19.9	20.0	20.2	20.3	20.5	20.6	20.7	20.9	21.0	21.2	21.3	21.4
70.5	19.8	19.9	20.1	20.2	20.4	20.5	20.6	20.8	20.9	21.0	21.2	21.3	21.5
70.0	19.8	19.9	20.1	20.2	20.4	20.5	20.6	20.8	20.9	21.0	21.2	21.3	21.5
69.5	19.8	20.0	20.1	20.2	20.4	20.5	20.6	20.8	20.9	21.1	21.2	21.3	21.5
69.0	19.8	20.0	20.1	20.3	20.4	20.5	20.7	20.8	21.0	21.1	21.2	21.4	21.5
68.5	19.9	20.0	20.1	20.3	20.4	20.5	20.7	20.8	21.0	21.1	21.2	21.4	21.5
68.0	19.9	20.0	20.2	20.3	20.4	20.6	20.7	20.8	21.0	21.1	21.3	21.4	21.6
67.5	19.9	20.0	20.2	20.3	20.4	20.6	20.7	20.9	21.0	21.2	21.3	21.4	21.6
67.0	19.9	20.1	20.2	20.3	20.5	20.6	20.7	20.9	21.0	21.2	21.3	21.5	21.6
66.5	19.9	20.1	20.2	20.4	20.5	20.6	20.8	20.9	21.0	21.2	21.3	21.5	21.6
66.0	20.0	20.1	20.2	20.4	20.5	20.7	20.8	20.9	21.1	21.2	21.4	21.5	21.6
65.5	20.0	20.1	20.3	20.4	20.5	20.7	20.8	21.0	21.1	21.2	21.4	21.5	21.7
65.0	20.0	20.1	20.3	20.4	20.6	20.7	20.9	21.0	21.1	21.3	21.4	21.5	21.7
64.5	20.0	20.2	20.3	20.4	20.6	20.7	20.9	21.0	21.2	21.3	21.4	21.6	21.7
64.0	20.0	20.2	20.3	20.5	20.6	20.7	20.9	21.0	21.2	21.3	21.4	21.6	21.7
63.5	20.1	20.2	20.3	20.5	20.6	20.8	20.9	21.1	21.2	21.3	21.5	21.6	21.7
63.0	20.1	20.2	20.3	20.5	20.6	20.8	20.9	21.1	21.2	21.3	21.5	21.6	21.7
62.5	20.1	20.2	20.4	20.5	20.6	20.8	20.9	21.1	21.2	21.3	21.5	21.6	21.8
62.0	20.1	20.2	20.4	20.5	20.7	20.8	20.9	21.1	21.2	21.4	21.5	21.6	21.8
61.5	20.1	20.3	20.4	20.5	20.7	20.8	21.0	21.1	21.2	21.4	21.5	21.7	21.8
61.0	20.1	20.3	20.4	20.6	20.7	20.8	21.0	21.1	21.3	21.4	21.5	21.7	21.8
60.5	20.2	20.3	20.4	20.6	20.7	20.9	21.0	21.1	21.3	21.4	21.6	21.7	21.8
60.0	20.2	20.3	20.5	20.6	20.7	20.9	21.0	21.2	21.3	21.4	21.6	21.7	21.9

--APPENDIX A--
(Attachment A-1)

AEROSOL GENERATOR PRESSURE (PSIG)= 6.25

AMBIENT BAROMETRIC PRESSURE IN CM HG

AMBIENT TEMPERATURE IN DEG F	72.0	72.5	73.0	73.5	74.0	74.5	75.0	75.5	76.0	76.5	77.0	77.5	78.0
80.0	20.5	20.6	20.8	20.9	21.0	21.2	21.3	21.5	21.6	21.7	21.9	22.0	22.2
79.5	20.5	20.6	20.8	20.9	21.1	21.2	21.3	21.5	21.6	21.8	21.9	22.1	22.2
79.0	20.5	20.6	20.8	20.9	21.1	21.2	21.4	21.5	21.6	21.8	21.9	22.1	22.2
78.5	20.5	20.7	20.8	21.0	21.1	21.2	21.4	21.5	21.7	21.8	21.9	22.1	22.2
78.0	20.5	20.7	20.8	21.0	21.1	21.3	21.4	21.5	21.7	21.8	22.0	22.1	22.3
77.5	20.6	20.7	20.8	21.0	21.1	21.3	21.4	21.6	21.7	21.8	22.0	22.1	22.3
77.0	20.6	20.7	20.9	21.0	21.2	21.3	21.4	21.6	21.7	21.9	22.0	22.2	22.3
76.5	20.6	20.8	20.9	21.0	21.2	21.3	21.5	21.6	21.8	21.9	22.1	22.2	22.3
76.0	20.6	20.8	20.9	21.1	21.2	21.4	21.5	21.6	21.8	21.9	22.1	22.2	22.4
75.5	20.7	20.8	20.9	21.1	21.2	21.4	21.5	21.7	21.8	22.0	22.2	22.3	22.4
75.0	20.7	20.8	21.0	21.1	21.3	21.4	21.5	21.7	21.8	22.0	22.2	22.3	22.4
74.5	20.7	20.8	21.0	21.1	21.3	21.4	21.6	21.7	21.9	22.0	22.2	22.3	22.5
74.0	20.7	20.8	21.0	21.2	21.3	21.5	21.6	21.7	21.9	22.0	22.2	22.3	22.5
73.5	20.7	20.8	21.0	21.2	21.3	21.5	21.6	21.7	21.9	22.0	22.2	22.3	22.5
73.0	20.7	20.8	21.0	21.2	21.3	21.5	21.6	21.8	21.9	22.0	22.2	22.3	22.5
72.5	20.8	20.9	21.0	21.2	21.3	21.5	21.6	21.8	21.9	22.1	22.2	22.3	22.5
72.0	20.8	20.9	21.1	21.2	21.4	21.5	21.6	21.8	21.9	22.1	22.2	22.4	22.5
71.5	20.8	20.9	21.1	21.2	21.4	21.5	21.7	21.8	22.0	22.1	22.2	22.4	22.5
71.0	20.8	21.0	21.1	21.2	21.4	21.5	21.7	21.8	22.0	22.1	22.3	22.4	22.5
70.5	20.8	21.0	21.1	21.3	21.4	21.6	21.7	21.8	22.0	22.1	22.3	22.4	22.6
70.0	20.9	21.0	21.1	21.3	21.4	21.6	21.7	21.9	22.0	22.2	22.3	22.4	22.6
69.5	20.9	21.0	21.2	21.3	21.5	21.6	21.7	21.9	22.0	22.2	22.3	22.5	22.6
69.0	20.9	21.0	21.2	21.3	21.5	21.6	21.8	21.9	22.1	22.2	22.4	22.5	22.7
68.5	20.9	21.1	21.2	21.4	21.5	21.7	21.8	22.0	22.1	22.2	22.4	22.5	22.7
68.0	20.9	21.1	21.2	21.4	21.5	21.7	21.8	22.0	22.1	22.3	22.4	22.6	22.7
67.5	21.0	21.1	21.3	21.4	21.6	21.7	21.9	22.0	22.2	22.3	22.4	22.6	22.7
67.0	21.0	21.1	21.3	21.4	21.6	21.7	21.9	22.0	22.2	22.3	22.5	22.6	22.8
66.5	21.0	21.2	21.3	21.5	21.6	21.7	21.9	22.0	22.2	22.3	22.5	22.6	22.8
66.0	21.0	21.2	21.3	21.5	21.6	21.8	21.9	22.1	22.2	22.3	22.5	22.6	22.8
65.5	21.0	21.2	21.3	21.5	21.6	21.8	21.9	22.1	22.2	22.4	22.5	22.7	22.8
65.0	21.1	21.2	21.3	21.5	21.6	21.8	22.0	22.1	22.2	22.4	22.5	22.7	22.8
64.5	21.1	21.2	21.4	21.5	21.7	21.8	22.0	22.1	22.3	22.4	22.6	22.7	22.9
64.0	21.1	21.2	21.4	21.5	21.7	21.8	22.0	22.1	22.3	22.4	22.6	22.7	22.9
63.5	21.1	21.3	21.4	21.6	21.7	21.9	22.0	22.1	22.3	22.4	22.6	22.7	22.9
63.0	21.1	21.3	21.4	21.6	21.7	21.9	22.0	22.2	22.3	22.5	22.6	22.7	22.9
62.5	21.2	21.3	21.4	21.6	21.7	21.9	22.0	22.2	22.3	22.5	22.6	22.8	22.9
62.0	21.2	21.3	21.5	21.6	21.8	21.9	22.1	22.2	22.3	22.5	22.6	22.8	22.9
61.5	21.2	21.3	21.5	21.6	21.8	21.9	22.1	22.2	22.4	22.5	22.7	22.8	23.0
61.0	21.2	21.4	21.5	21.7	21.8	22.0	22.1	22.2	22.4	22.5	22.7	22.8	23.0
60.5	21.2	21.4	21.5	21.7	21.8	22.0	22.1	22.3	22.4	22.6	22.7	22.9	23.0
60.0	21.3	21.4	21.6	21.7	21.8	22.0	22.1	22.3	22.4	22.6	22.7	22.9	23.0

--APPENDIX A--

ATTACHMENT A-2:

Fortran Computer Program Listing
Used To Generate Table A-1

--APPENDIX A--
(Attachment A-2)

FORTRAN COMPUTER PROGRAM LISTING
USED TO GENERATE TABLE A-1

```
C THIS PROGRAM PRODUCES A TABLE FOR USE IN THE USAFSAM DEHP RQFT
C INSTRUMENT CALIBRATION PROCEDURE (DYNATECH FRONTIER CORP. MODEL
C FE259H).
C
C
      DIMENSION QT(40),DELTA P(41,13),T1(42),P(13)
      REAL MG
      INTEGER TEMP,PRESS
      BYTE WORD(41)
      OPEN (UNIT=1,DISPOSE='SAVE',TYPE='NEW',NAME='TABLE.DAT')
        WORD(6)='A'
        WORD(7)='M'
        WORD(8)='B'
        WORD(9)='I'
        WORD(10)='E'
        WORD(11)='N'
        WORD(12)='T'
        WORD(13)=' '
        WORD(14)='T'
        WORD(15)='E'
        WORD(16)='M'
        WORD(17)='P'
        WORD(18)='E'
        WORD(19)='R'
        WORD(20)='A'
        WORD(21)='T'
        WORD(22)='U'
        WORD(23)='R'
        WORD(24)='E'
        WORD(25)=' '
        WORD(26)='I'
        WORD(27)='N'
        WORD(28)=' '
        WORD(29)='D'
        WORD(30)='E'
        WORD(31)='G'
        WORD(32)=' '
        WORD(33)='F'
      DO 15 I2=1,5
   15 WORD(I2)=' '
      DO 17 I3=34,41
   17 WORD(I3)=' '
C
C THE FOLLOWING SET OF VARIABLES ARE UNIQUE INSTRUMENTAL
C CALIBRATION CONSTANTS SUPPLIED BY THE MANUFACTURER:
      A0=(-23.9)
      A1=9.26
      B0=17.2
      B1=2.72
      K=119.0
C
C
C QT(I)=THE TOTAL SYSTEM VOLUMETRIC AEROSOL FLOW RATE
C       (LITERS/MIN OR CFM X 28.32). RANGE OF QT(I) IS
C       3-40 CFM.
```

--APPENDIX A--
(Attachment A-2)

```
C
C C= 30 MICROGRAM/LITER = CHAMBER CONCENTRATION OF
C  DEHP (MICROGRAM/LITER)
      C=30.
C
C MG=C/1000 X QT(I)=AEROSOL GENERATOR MASS FLOW RATE
C
C
C T(1)=INITIAL TEMPERATURE IN FAHRENHEIT
      T1(1)=80.
C
      WRITE(1,5)
    5 FORMAT ('1',T31,'TABLE1.  AEROSOL GENERATOR AIR PRESSURE VERSUS '
     *,'AEROSOL DILUTION AIR'/T31,'DIFFERENTIAL PRESSURE (MAGNEHELIC GUA
     *GE SETTING) FOR VARIOUS AMBIENT'/T46,'TEMPERATURES AND BAROMETRIC
     * PRESSURES')
C
C
      DO 10 I=3,40
C P(PRESS)=72.=INITIAL AMBIENT BAROMETRIC PRESSURE (CM HG)
      P(1)=72.
      QT(I)=I*28.32
      MG=C/1000*QT(I)
C PG=(MG-A0)/A1=AEROSOL GENERATOR PRESSURE (PSIG)
      PG=(MG-A0)/A1
C QG=B1 X PG + B0=VOLUMETRIC AEROSOL GENERATOR FLOW RATE (LITERS/MIN)
      QG=B1*PG+B0
C QD=QT(I)-QG = VOLUMETRIC AEROSOL GENERATOR FLOW RATE (LITERS/MIN)
      QD=QT(I)-QG
C
C PRINT TABLE HEADINGS
      WRITE (1,25) PG
   25 FORMAT ('0',T47,'AEROSOL GENERATOR PRESSURE (PSIG)=',F5.2///
     *T48,'AMBIENT BAROMETRIC PRESSURE IN CM HG'///)
C
C  CALCULATE DELTA P
      DO 20 PRESS=1,13
      DO 30 TEMP=1,41
C CHANGE FROM FAHRENHEIT TO KELVIN
      T=(T1(TEMP)-32.)*(5./9.)+273.15
      DELTA P(TEMP,PRESS)=(QD/K)**2*(P(PRESS)/T)
   30 T1(TEMP+1)=T1(TEMP)-0.5
   20 P(PRESS+1)=P(PRESS)+0.5
C  PRINT TABLE COLUMNS
      WRITE (1,35) (P(PRESS),PRESS=1,13)
   35 FORMAT (' ',T15,'|',T17,F4.1,12(5X,F4.1))
      WRITE (1,36)
   36 FORMAT (' ',T9,'-----------------------------------------
     *-------------------------------------------------
     *-----------------')
C PRINT TABLE VALUES
      DO 40 TEMP=1,41
      WRITE (1,45) WORD(TEMP),T1(TEMP)
     *,(DELTA P(TEMP,PRESS),PRESS=1,13)
   45 FORMAT (' ',T6,A1,T9,F4.1,T15,'|',T17,12(F4.1,5X),F4.1)
```

```
   40 CONTINUE
      WRITE (1,36)
      WRITE (1,47)
   47 FORMAT('1')
C
C
C ANOTHER AEROSOL GENERATOR PRESSURE SETTING ( ANOTHER PAGE PRINTED)
   10 CONTINUE
      CLOSE (UNIT=1)
      STOP
      END
```

APPENDIX B:

DEHPRQFT.FOR Fortran Listing

--APPENDIX B--

DEHPRQFT.FOR Fortran Listing

```
C
C     THIS PROGRAM CALCULATES PROTECTION FACTORS FOR DATA COLLECTED ON
C     THE USAFSAM/VNL DI-2-ETHYLHEXYL PHTHALATE (DEHP) RESPIRATOR
C     QUANTITATIVE FIT TEST (RQFT) INSTRUMENT.
C
C     THE CALCULATION OF A RESPIRATOR'S PROTECTION FACTOR (PF) IS
C     ACCOMPLISHED USING THE FOLLOWING RELATIONSHIP:
C
C        PF=(CC)/(RL)
C
C     WHERE,
C
C        PF=PROTECTION FACTOR
C
C        CC=AVERAGE CORRECTED CHAMBER CHALLENGE CONCENTRATION
C
C        RL=AVERAGE CORRECTED RESPIRATOR LEAKAGE CONCENTRATION FOR A
C           PARTICULAR EXERCISE
C
C
C     THE AVERAGE CORRECTED CHAMBER CHALLENGE CONCENTRATION (CC) IS
C     GIVEN BY:
C
C        CC=[(CI+CF)(KCC)/2 - (BI+BF)(KBC)/2]
C
C     OR EQUIVALENTLY (SINCE THERE IS A ONE-TO-ONE CORRESPONDENCE
C     BETWEEN THE SCATTERED LIGHT PHOTOMETER'S OUTPUT VOLTAGE AND THE
C     CONCENTRATION OF DEHP),
C
C        CC=[(VCI+VCF)(KCC)/2 - (VBI+VBF)(KBC)/2]
C
C     WHERE,
C
C        CI=AVERAGE INITIAL CHAMBER CHALLENGE CONCENTRATION (MEASURED
C           AFTER THE SUBJECT ENTERS THE CHAMBER AND JUST PRIOR TO
C           INITIATING THE FIRST EXERCISE)
C
C        CF=AVERAGE FINAL CHAMBER CHALLENGE CONCENTRATION (MEASURED
C           AFTER ALL EXERCISES HAVE BEEN COMPLETED AND JUST PRIOR TO
C           THE SUBJECT'S EXIT FROM THE CHAMBER)
C
C        KCC=INSTRUMENT'S SAMPLING RANGE SWITCH POSITION (TYPICALLY
C            100 PERCENT)
C
C        BI=AVERAGE INITIAL BASELINE CONCENTRATION (MEASURED AFTER
C           THE SUBJECT ENTERS THE CHAMBER AND JUST PRIOR TO
C           INITIATING THE FIRST EXERCISE)
C
C        BF=AVERAGE FINAL BASELINE CONCENTRATION (MEASURED AFTER ALL
C           EXERCISES HAVE BEEN COMPLETED AND JUST PRIOR TO THE
C           SUBJECT'S EXIT FROM THE CHAMBER)
C
C        KBC=INSTRUMENT'S SAMPLING RANGE SWITCH POSITION (TYPICALLY
C            10.0 - 0.01 PERCENT)
C
C        VCI=AVERAGE INITIAL VOLTAGE RESPONSE OF THE SCATTERED LIGHT
C            PHOTOMETER (CORRESPONDS TO THE VALUE FOR CI)
```

```
C
C        VCF=AVERAGE FINAL VOLTAGE RESPONSE OF THE SCATTERED LIGHT
C            PHOTOMETER (CORRESPONDS TO THE VALUE FOR CF)
C
C        VBI=AVERAGE INITIAL VOLTAGE RESPONSE OF THE SCATTERED LIGHT
C            PHOTOMETER (CORRESPONDS TO THE VALUE OF BI)
C
C        VBF=AVERAGE FINAL VOLTAGE RESPONSE OF THE SCATTERED LIGHT
C            PHOTOMETER (CORRESPONDS TO THE VALUE OF BF)
C
C
C     THE AVERAGE CORRECTED RESPIRATOR LEAKAGE CONCENTRATION (RL) IS
C     GIVEN BY:
C
C        RL=[(RE)(KE) - (BI+BF)(KBC)/2]
C
C     OR EQUIVALENTLY (SINCE THERE IS A ONE-TO-ONE CORRESPONDENCE
C     BETWEEN THE SCATTERED LIGHT PHOTOMETER'S OUTPUT VOLTAGE AND THE
C     CONCENTRATION OF DEHP),
C
C        RL=[(ASLPVO)(KE) - (VBI+VBF)(KBC)/2]
C
C     WHERE,
C
C        RE=AVERAGE RESPIRATOR LEAKAGE CONCENTRATION FOR A PARTICULAR
C           EXERCISE
C
C        KE=INSTRUMENT'S SAMPLING RANGE SWITCH POSITION USED DURING
C           THE EXERCISE MEASUREMENT TIME PERIOD (TYPICALLY 10 - 0.01
C           PERCENT)
C
C        ASLPVO=AVERAGE SCATTERED LIGHT PHOTOMETER VOLTAGE OUTPUT
C               FOR A PARTICULAR EXERCISE (CORRESPONDS TO THE VALUE
C               OF RE)
C
C*************************************************************************
C*****                                                              *******
C*****  IF YOU HAVE ANY QUESTIONS CONCERNING THIS PROGRAM CALL      *******
C*****                                                              *******
C*****            CAPTAIN EDWARD S. KOLESAR, JR.                    *******
C*****                                                              *******
C*****             USAFSAM/VNL   BROOKS AFB  TX                     *******
C*****                                                              *******
C*****       AUTOVON 240-2154 OR COMMERCIAL (512)536-2154           *******
C*****                                                              *******
C*************************************************************************
C
C
      IMPLICIT INTEGER*4 (I-N)
      INTEGER FILTK
      REAL KBC,KCC
      DIMENSION ICCBS(2),IC(20),ICTP(20),SRSP(20),PF(20),RL(20),XC(20)
      BYTE SECN(9),P(10),C(10),NAME(45),MASK(45),DATE(45),TIME(45)
      BYTE GROUP 1,GROUP 2,YES,NO,REP,SELECT(7)
      DATA SECN/'1','2','3','4','5','6','7','8','9'/
      YES='Y'
      NO='N'
```

--APPENDIX B--

```
C
C     ICCBS(*) AND 4137 FORMAT ELEMENTS ARE USED IN A CRT
C     SCREEN CLEARING ALGORITHM
C
      ICCBS(1)=72*256+27
      ICCBS(2)=74*256+27
 4137 FORMAT(1H ,2A2)
C
C     ESTABLISH A FILE COUNTER AND DECLARE THE FILE NAMES
C
 5101 FILTK=1
C
C     THE FILE CALLED DATX.XXX CONTAINS THE RQFT DESCRIPTIVE
C     INFORMATION, DEHP CALIBRATION DATA, AND EXERCISE INTEGRATOR
C     COUNT DATA
C
C     THE FILE CALLED CALCX.XXX CONTAINS THE RQFT DESCRIPTIVE
C     INFORMATION, THE EXERCISE PF CALCULATIONS, AND ARITHMETIC
C     AVERAGE AND TIME-WEIGHTED AVERAGE PF CALCULATIONS
C
C     THE FILES ARE NUMBERED SEQUENTIALLY SO THAT THEY CAN BE EASILY
C     RETRIEVED FOR PRINTING AND ANALYSIS
C
C     THE FILES THAT HOLD VARIOUS SEGMENTS OF DATA ARE NAMED
C
      P(1)='D'
      P(2)='A'
      P(3)='T'
      P(4)='A'
      P(5)=SECN(FILTK)
      P(6)='.'
      P(10)=0
      C(1)='C'
      C(2)='A'
      C(3)='L'
      C(4)='C'
      C(5)=SECN(FILTK)
      C(6)='.'
      C(10)=0
      TYPE 2006
 2006 FORMAT(1X,' '///)
      TYPE 4137,ICCBS(1),ICCBS(2)
      TYPE 2006
      GO TO 3081
C
C     IF MORE THAN ONE SET OF RQFT DATA IS TO BE PROCESSED
C     DURING A COMPUTER RUN, THE FILE COUNTER IS AUTOMATICALLY
C     INCREMENTED TO FACILITATE KEEPING TRACK OF THE DATAX.XXX
C     AND CALCX.XXX FILES
C
 6000 FILTK=FILTK+1
      P(5)=SECN(FILTK)
      C(5)=SECN(FILTK)
      TYPE 2006
      TYPE 4137,ICCBS(1),ICCBS(2)
      TYPE 2006
 3081 CONTINUE
```

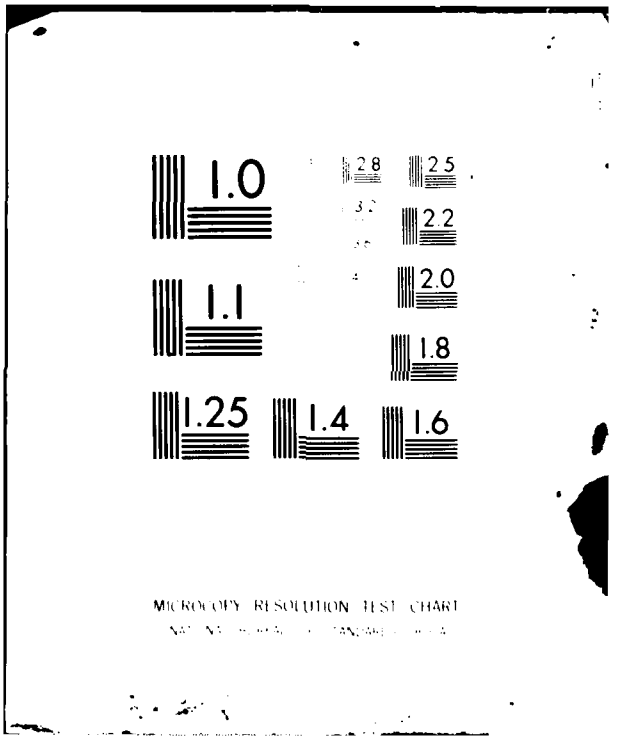
```
      TYPE 2002
 2002 FORMAT(1X,'USER ATTENTION:  IN ORDER TO KEEP TRACK OF THE  '/
     C' DATA FILES (DATAX.XXX) BEING ANALYZED, IT IS RECOMMENDED  '/
     C' THAT THEY BE SEQUENTIALLY NUMBERED.'/)
      TYPE 306
 306  FORMAT(1X,' '/)
      TYPE 2003
 2003 FORMAT(1X,'ENTER THE FOLLOWING:  001 FOR THE FIRST DATA '/
     C' FILE; 002 FOR THE SECOND DATA FILE; 003 FOR THE THIRD'/
     C' DATA FILE; ETC.'/)
      TYPE 306
      TYPE 2004
 2004 FORMAT(1X,'ENTRY= ',$)
      ACCEPT 2005,P(7),P(8),P(9)
 2005 FORMAT(3A1)
      TYPE 2006
      TYPE 4137,ICCBS(1),ICCBS(2)
      TYPE 2006
      TYPE 5100
 5100 FORMAT(1X,'USER ATTENTION:  IN ORDER TO KEEP TRACK OF THE'/
     C' CALCULATION FILES (CALCX.XXX), IT IS RECOMMENDED THAT '/
     C' THEY BE SEQUENTIALLY NUMBERED.'/)
      TYPE 306
      TYPE 5200
 5200 FORMAT(1X,'ENTER THE FOLLOWING:  001 FOR THE FIRST '/
     C' CALCULATION FILE; 002 FOR THE SECOND CALCULATION FILE; '/
     C' 003 FOR THE THIRD CALCULATION FILE; ETC.'/)
      TYPE 306
      TYPE 2004
      ACCEPT 2005,C(7),C(8),C(9)
      TYPE 2006
      TYPE 4137,ICCBS(1),ICCBS(2)
      TYPE 2006
      OPEN(UNIT=2,NAME=B,DISPOSE='SAVE',TYPE='NEW')
      OPEN(UNIT=3,NAME=C,DISPOSE='SAVE',TYPE='NEW')
C
C     THE RQFT DATA TO BE PROCESSED IS NOW ENTERED
C
C     ENTER THE DESCRIPTIVE INFORMATION CONCERNING THE SUBJECT,
C     RESPIRATOR TYPE, DATE, AND TIME TESTED
C
      TYPE 2006
      TYPE 4137,ICCBS(1),ICCBS(2)
      TYPE 2006
      TYPE 5300
 5300 FORMAT(1X,'DEHP RQFT DATA: '/)
      TYPE 2006
      TYPE 3085
 3085 FORMAT(1X,'SUBJECT NAME:  ',2X,$)
      ACCEPT 3086,NAME
 3086 FORMAT(45A1)
      TYPE 3087
 3087 FORMAT(1X,'TYPE OF RESPIRATOR:  ',2X,$)
      ACCEPT 3086,MASK
      TYPE 3088
 3088 FORMAT(1X,'DATE TESTED:  ',2X,$)
      ACCEPT 3086,DATE
```

```
      TYPE 3089
 3089 FORMAT(1X,'TIME TESTED:  ',2X,$)
      ACCEPT 3086,TIME
      TYPE 2006
C
C     THE DEHP RQFT CALIBRATION DATA IS ENTERED
C
C     THIS INFORMATION IS AVAILABLE FROM THE DATA SHEET USED
C     DURING AN RQFT
C
      TYPE 2006
      TYPE 4137,ICCBS(1),ICCBS(2)
      TYPE 2006
      TYPE 99
   99 FORMAT(1X,'DEPRESS THE RETURN KEY AFTER ENTERING A'/
     C' SWITCH POSITION AND VOLTAGE'/////)
      TYPE 2006
      TYPE 40
   40 FORMAT(1X,'DEHP RQFT CALIBRATION DATA: '///)
      TYPE 41
   41 FORMAT(1X,'CALIBRATION PARAMETER',17X,'SAMPLING RANGE',8X,'AVERAGE
     C')
      TYPE 42
   42 FORMAT(1X,38X,'SWITCH POSITION',7X,'VOLTAGE')
      TYPE 43
   43 FORMAT(1X,39X,'(IN PERCENT)',8X,'(IN VOLTS)'/)
      TYPE 44
   44 FORMAT(1X,'AVERAGE INITIAL VOLTAGE')
      TYPE 45
   45 FORMAT(1X,'ASSOCIATED WITH THE MAXIMUM')
      TYPE 46
   46 FORMAT(1X,'CHAMBER CHALLENGE CONCENTRATION           ',$)
      ACCEPT 64,KCC
      CALL CLEAR(LINES)
      TYPE 47,KCC
   47 FORMAT(1H+,'CHAMBER CHALLENGE CONCENTRATION',T44,F6.2,T63,1H ,$)
      ACCEPT 48,VCI
   48 FORMAT(1F6.3)
      TYPE 306
      TYPE 49
   49 FORMAT(1X,'AVERAGE INITIAL VOLTAGE')
      TYPE 50
   50 FORMAT(1X,'ASSOCIATED WITH THE BASELINE')
      TYPE 51
   51 FORMAT(1X,'OF THE DEHP RQFT INSTRUMENT                ',$)
      ACCEPT 64,KBC
      CALL CLEAR(LINES)
      TYPE 52,KBC
   52 FORMAT(1H+,'OF THE DEHP RQFT INSTRUMENT',T44,F6.2,T63,1H ,$)
      ACCEPT 48,VBI
      TYPE 306
      TYPE 53
   53 FORMAT(1X,'AVERAGE FINAL VOLTAGE')
      TYPE 50
      TYPE 51
      ACCEPT 64,KBC
      CALL CLEAR(LINES)
```

```
      TYPE 52,KBC
      ACCEPT 48,VBF
      TYPE 306
      TYPE 53
      TYPE 45
      TYPE 46
      ACCEPT 64,KCC
      CALL CLEAR(LINES)
      TYPE 47,KCC
      ACCEPT 48,VCF
      TYPE 2006
      TYPE 4137,ICCBS(1),ICCBS(2)
      TYPE 2006
C
C     SELECT THE PROPER EXERCISE PROTOCOL
C
      TYPE 3127
 3127 FORMAT(1X,'THE USER IS FREE TO SELECT ONE OF TWO GROUPS OF'/
     C' EXERCISE PROTOCOLS'//)
      TYPE 3128
 3128 FORMAT(1X,'THE [GROUP 1] EXERCISE PROTOCOL CONSISTS OF:'//
     C' [1]  NORMAL BREATHING STRAIGHT AHEAD'/
     C' [2]  DEEP BREATHING STRAIGHT AHEAD'/
     C' [3]  TALKING'/
     C' [4]  SIDE-TO-SIDE HEAD MOVEMENTS (DEEP BREATHING)'/
     C' [5]  UP-AND-DOWN HEAD MOVEMENTS  (DEEP BREATHING)'/
     C' [6]  FACIAL GRIMACING'///)
      TYPE 2006
      TYPE 4137,ICCBS(1),ICCBS(2)
      TYPE 2006
      TYPE 3129
 3129 FORMAT(1X,'THE [GROUP 2] EXERCISE PROTOCOL CONSISTS OF:'//
     C' [1]  NORMAL BREATHING STRAIGHT AHEAD'/
     C' [2]  NORMAL BREATHING LEFT'/
     C' [3]  NORMAL BREATHING RIGHT'/
     C' [4]  NORMAL BREATHING DOWN'/
     C' [5]  NORMAL BREATHING UP'/
     C' [6]  DEEP BREATHING STRAIGHT AHEAD'/
     C' [7]  DEEP BREATHING LEFT'/
     C' [8]  DEEP BREATHING RIGHT')
      TYPE 3130
 3130 FORMAT(1X,'[9]  DEEP BREATHING DOWN'/
     C' [10] DEEP BREATHING UP'/
     C' [11] TALKING'/
     C' [12] FACIAL GRIMACING'/
     C' [13] SIDE-TO-SIDE HEAD MOVEMENTS (NORMAL BREATHING)'/
     C' [14] UP-AND-DOWN HEAD MOVEMENTS  (NORMAL BREATHING)'/
     C' [15] SIDE-TO-SIDE HEAD MOVEMENTS (DEEP BREATHING)'/
     C' [16] UP-AND-DOWN HEAD MOVEMENTS  (DEEP BREATHING)'//)
 4138 TYPE 2006
      TYPE 4137,ICCBS(1),ICCBS(2)
      TYPE 2006
      TYPE 3131
 3131 FORMAT(1X,'TO SPECIFY THE EXERCISE PROTOCOL GROUP OF INTEREST,'/
     C' TYPE EITHER:  GROUP 1    OR    GROUP 2    ')
      TYPE 306
      TYPE 2004
```

AD-A115 327 SCHOOL OF AEROSPACE MEDICINE BROOKS AFB TX F/G 6/11
AUTOMATED CALCULATION OF PROTECTION FACTORS FOR THE DI-2-ETHYLH--ETC(U)
DEC 81 E S KOLESAR
UNCLASSIFIED SAM-TR-81-35 NL

2 OF 2


1.0
2.8
2.5
2.2
1.1
2.0
1.8
1.25
1.4
1.6
MICROCOPY RESOLUTION TEST CHART

```
      ACCEPT 3122,SELECT
 3122 FORMAT(7A1)
      IF(SELECT(7).NE.'1'.AND.SELECT(7).NE.'2') GO TO 4138
      TYPE 2006
      TYPE 4137,ICCBS(1),ICCBS(2)
      TYPE 2006
C
C     ENTER THE EXERCISE INTEGRATION COUNT DATA
C
C     THIS INFORMATION IS AVAILABLE FROM THE DATA SHEET USED
C     DURING THE RQFT
C
      TYPE 3021
 3021 FORMAT(1X,'USER ATTENTION:  IF NO EXERCISE COUNT DATA WAS'/
     C' COLLECTED FOR A PARTICULAR EXERCISE, TYPE:  000001.  ALSO,'/
     C' FOR EACH EXERCISE INTEGRATOR COUNT DATA ENTRY, SIX DIGITS MUST')
      TYPE 3022
 3022 FORMAT(1X,'BE TYPED, THAT IS, IF YOU HAVE A SIX DIGIT NUMBER,'/
     C' TYPE ALL SIX DIGITS.  IF YOU HAVE A FIVE DIGIT NUMBER, TYPE'/
     C' ONE LEADING ZERO AND THEN THE FIVE DIGITS.  IF YOU HAVE A')
      TYPE 3033
 3033 FORMAT(' FOUR DIGIT NUMBER, TYPE TWO LEADING ZEROS AND THEN THE'/
     C' FOUR DIGITS, ETC.  SEVERAL EXAMPLES FOLLOW AS AN ILLUSTRATION')
      TYPE 3034
 3034 FORMAT(1X,'FOR EXAMPLE:  COUNT DATA=743182   TYPED ENTRY=743182')
      TYPE 3035
 3035 FORMAT(1X,'FOR EXAMPLE:  COUNT DATA=18726    TYPED ENTRY=018726')
      TYPE 3036
 3036 FORMAT(1X,'FOR EXAMPLE:  COUNT DATA=6412     TYPED ENTRY=006412')
      TYPE 2006
      TYPE 4137,ICCBS(1),ICCBS(2)
      TYPE 2006
      TYPE 3119
 3119 FORMAT(1X,'DEPRESS THE RETURN KEY AFTER ENTERING AN'/
     C' INTEGRATOR COUNT MAGNITUDE, TIME PERIOD, AND'/
     C' SWITCH POSITION'/)
      TYPE 2006
      TYPE 3037
 3037 FORMAT(1X,'EXERCISE INTEGRATOR COUNT INFORMATION:'/)
      TYPE 3038
 3038 FORMAT(1X,'EXERCISE',26X,'INTEGRATOR',3X,'TIME PERIOD',6X,'SAMPLIN
     CG RANGE')
      TYPE 3126
 3126 FORMAT(1X,37X,'COUNT',5X,'(IN SECONDS)',5X,'SWITCH POSITION')
      TYPE 61
   61 FORMAT(1X,64X,'(AS A PERCENT)'/)
      IF(SELECT(7).EQ.'2') GO TO 3133
      TYPE 3039
 3039 FORMAT(1X,'NORMAL BREATHING STRAIGHT AHEAD    ',$)
      ACCEPT 3040,IC1
 3040 FORMAT(I6)
      CALL CLEAR(LINES)
      TYPE 3112,IC1
 3112 FORMAT(1H+,'NORMAL BREATHING STRAIGHT AHEAD',T37,I6,T52,1H ,$)
      ACCEPT 3113,ICTP1
 3113 FORMAT(I2)
      CALL CLEAR(LINES)
```

```
      TYPE 62,IC1,ICTP1
   62 FORMAT(1H+,'NORMAL BREATHING STRAIGHT AHEAD',T37,I6,T53,I2,T69,1H
     C ,$)
      ACCEPT 64,SRSP1
      TYPE 3041
 3041 FORMAT(1X,'DEEP BREATHING STRAIGHT AHEAD      ',$)
      ACCEPT 3040,IC2
      CALL CLEAR(LINES)
      TYPE 3114,IC2
 3114 FORMAT(1H+,'DEEP BREATHING STRAIGHT AHEAD',T37,I6,T52,1H ,$)
      ACCEPT 3113,ICTP2
      CALL CLEAR(LINES)
      TYPE 63,IC2,ICTP2
   63 FORMAT(1H+,'DEEP BREATHING STRAIGHT AHEAD',T37,I6,T53,I2,T69,1H ,$
     C)
   64 FORMAT(1F6.2)
      ACCEPT 64,SRSP2
      TYPE 3042
 3042 FORMAT(1X,'TALKING                              ',$)
      ACCEPT 3040,IC3
      CALL CLEAR(LINES)
      TYPE 3115,IC3
 3115 FORMAT(1H+,'TALKING',T37,I6,T52,1H ,$)
      ACCEPT 3113,ICTP3
      CALL CLEAR(LINES)
      TYPE 65,IC3,ICTP3
   65 FORMAT(1H+,'TALKING',T37,I6,T53,I2,T69,1H ,$)
      ACCEPT 64,SRSP3
      TYPE 3043
 3043 FORMAT(1X,'SIDE-TO-SIDE HEAD MOVEMENTS'/
     C' (DEEP BREATHING)                  ',$)
      ACCEPT 3040,IC4
      CALL CLEAR(LINES)
      TYPE 3116,IC4
 3116 FORMAT(1H+,'(DEEP BREATHING)',T37,I6,T52,1H ,$)
      ACCEPT 3113,ICTP4
      CALL CLEAR(LINES)
      TYPE 66,IC4,ICTP4
   66 FORMAT(1H+,'(DEEP BREATHING)',T37,I6,T53,I2,T69,1H ,$)
      ACCEPT 64,SRSP4
      TYPE 3044
 3044 FORMAT(1X,'UP-AND-DOWN HEAD MOVEMENTS'/
     C' (DEEP BREATHING)                  ',$)
      ACCEPT 3040,IC5
      CALL CLEAR(LINES)
      TYPE 3116,IC5
      ACCEPT 3113,ICTP5
      CALL CLEAR(LINES)
      TYPE 66,IC5,ICTP5
      ACCEPT 64,SRSP5
      TYPE 3045
 3045 FORMAT(1X,'FACIAL GRIMACING                     ',$)
      ACCEPT 3040,IC6
      CALL CLEAR(LINES)
      TYPE 3117,IC6
 3117 FORMAT(1H+,'FACIAL GRIMACING',T37,I6,T52,1H ,$)
      ACCEPT 3113,ICTP6
```

```
      CALL CLEAR(LINES)
      TYPE 67,IC6,ICTP6
   67 FORMAT(1H+,'FACIAL GRIMACING',T37,I6,T53,I2,T69,1H ,$)
      ACCEPT 64,SRSP6
      TYPE 2006
      TYPE 4137,ICCBS(1),ICCBS(2)
      TYPE 2006
      GO TO 3153
 3133 CONTINUE
      TYPE 3039
      ACCEPT 3040,IC1
      CALL CLEAR(LINES)
      TYPE 3112,IC1
      ACCEPT 3113,ICTP1
      CALL CLEAR(LINES)
      TYPE 62,IC1,ICTP1
      ACCEPT 64,SRSP1
      TYPE 3134
 3134 FORMAT(1X,'NORMAL BREATHING LEFT              ',$)
      ACCEPT 3040,IC2
      CALL CLEAR(LINES)
      TYPE 3135,IC2
 3135 FORMAT(1H+,'NORMAL BREATHING LEFT',T37,I6,T52,1H ,$)
      ACCEPT 3113,ICTP2
      CALL CLEAR(LINES)
      TYPE 68,IC2,ICTP2
   68 FORMAT(1H+,'NORMAL BREATHING LEFT',T37,I6,T53,I2,T69,1H ,$)
      ACCEPT 64,SRSP2
      TYPE 3136
 3136 FORMAT(1X,'NORMAL BREATHING RIGHT             ',$)
      ACCEPT 3040,IC3
      CALL CLEAR(LINES)
      TYPE 3137,IC3
 3137 FORMAT(1H+,'NORMAL BREATHING RIGHT',T37,I6,T52,1H ,$)
      ACCEPT 3113,ICTP3
      CALL CLEAR(LINES)
      TYPE 69,IC3,ICTP3
   69 FORMAT(1H+,'NORMAL BREATHING RIGHT',T37,I6,T53,I2,T69,1H ,$)
      ACCEPT 64,SRSP3
      TYPE 3138
 3138 FORMAT(1X,'NORMAL BREATHING DOWN              ',$)
      ACCEPT 3040,IC4
      CALL CLEAR(LINES)
      TYPE 3139,IC4
 3139 FORMAT(1H+,'NORMAL BREATHING DOWN',T37,I6,T52,1H ,$)
      ACCEPT 3113,ICTP4
      CALL CLEAR(LINES)
      TYPE 70,IC4,ICTP4
   70 FORMAT(1H+,'NORMAL BREATHING DOWN',T37,I6,T53,I2,T69,1H ,$)
      ACCEPT 64,SRSP4
      TYPE 3140
 3140 FORMAT(1X,'NORMAL BREATHING UP                ',$)
      ACCEPT 3040,IC5
      CALL CLEAR(LINES)
      TYPE 3141,IC5
 3141 FORMAT(1H+,'NORMAL BREATHING UP',T37,I6,T52,1H ,$)
      ACCEPT 3113,ICTP5
```

```
      CALL CLEAR(LINES)
      TYPE 71,IC5,ICTP5
   71 FORMAT(1H+,'NORMAL BREATHING UP',T37,I6,T53,I2,T69,1H ,$)
      ACCEPT 64,SRSP5
      TYPE 3041
      ACCEPT 3040,IC6
      CALL CLEAR(LINES)
      TYPE 3114,IC6
      ACCEPT 3113,ICTP6
      CALL CLEAR(LINES)
      TYPE 63,IC6,ICTP6
      ACCEPT 64,SRSP6
      TYPE 3142
 3142 FORMAT(1X,'DEEP BREATHING LEFT                ',$)
      ACCEPT 3040,IC7
      CALL CLEAR(LINES)
      TYPE 3143,IC7
 3143 FORMAT(1H+,'DEEP BREATHING LEFT',T37,I6,T52,1H ,$)
      ACCEPT 3113,ICTP7
      CALL CLEAR(LINES)
      TYPE 72,IC7,ICTP7
   72 FORMAT(1H+,'DEEP BREATHING LEFT',T37,I6,T53,I2,T69,1H ,$)
      ACCEPT 64,SRSP7
      TYPE 3144
 3144 FORMAT(1X,'DEEP BREATHING RIGHT               ',$)
      ACCEPT 3040,IC8
      CALL CLEAR(LINES)
      TYPE 3145,IC8
 3145 FORMAT(1H+,'DEEP BREATHING RIGHT',T37,I6,T52,1H ,$)
      ACCEPT 3113,ICTP8
      CALL CLEAR(LINES)
      TYPE 73,IC8,ICTP8
   73 FORMAT(1H+,'DEEP BREATHING RIGHT',T37,I6,T53,I2,T69,1H ,$)
      ACCEPT 64,SRSP8
      TYPE 3146
 3146 FORMAT(1X,'DEEP BREATHING DOWN                ',$)
      ACCEPT 3040,IC9
      CALL CLEAR(LINES)
      TYPE 3147,IC9
 3147 FORMAT(1H+,'DEEP BREATHING DOWN',T37,I6,T52,1H ,$)
      ACCEPT 3113,ICTP9
      CALL CLEAR(LINES)
      TYPE 74,IC9,ICTP9
   74 FORMAT(1H+,'DEEP BREATHING DOWN',T37,I6,T53,I2,T69,1H ,$)
      ACCEPT 64,SRSP9
      TYPE 3148
 3148 FORMAT(1X,'DEEP BREATHING UP                  ',$)
      ACCEPT 3040,IC10
      CALL CLEAR(LINES)
      TYPE 3149,IC10
 3149 FORMAT(1H+,'DEEP BREATHING UP',T37,I6,T52,1H ,$)
      ACCEPT 3113,ICTP10
      CALL CLEAR(LINES)
      TYPE 75,IC10,ICTP10
   75 FORMAT(1H+,'DEEP BREATHING UP',T37,I6,T53,I2,T69,1H ,$)
      ACCEPT 64,SRSP10
      TYPE 3042
```

```
      ACCEPT 3040,IC11
      CALL CLEAR(LINES)
      TYPE 3115,IC11
      ACCEPT 3113,ICTP11
      CALL CLEAR(LINES)
      TYPE 65,IC11,ICTP11
      ACCEPT 64,SRSP11
      TYPE 3045
      ACCEPT 3040,IC12
      CALL CLEAR(LINES)
      TYPE 3117,IC12
      ACCEPT 3113,ICTP12
      CALL CLEAR(LINES)
      TYPE 67,IC12,ICTP12
      ACCEPT 64,SRSP12
      TYPE 3150
 3150 FORMAT(1X,'SIDE-TO-SIDE HEAD MOVEMENTS'/
     C' (NORMAL BREATHING)                    ',$)
      ACCEPT 3040,IC13
      CALL CLEAR(LINES)
      TYPE 3151,IC13
 3151 FORMAT(1H+,'(NORMAL BREATHING)',T37,I6,T52,1H ,$)
      ACCEPT 3113,ICTP13
      CALL CLEAR(LINES)
      TYPE 76,IC13,ICTP13
   76 FORMAT(1H+,'(NORMAL BREATHING)',T37,I6,T53,I2,T69,1H ,$)
      ACCEPT 64,SRSP13
      TYPE 3152
 3152 FORMAT(1X,'UP-AND-DOWN HEAD MOVEMENTS'/
     C' (NORMAL BREATHING)                    ',$)
      ACCEPT 3040,IC14
      CALL CLEAR(LINES)
      TYPE 3151,IC14
      ACCEPT 3113,ICTP14
      CALL CLEAR(LINES)
      TYPE 76,IC14,ICTP14
      ACCEPT 64,SRSP14
      TYPE 3043
      ACCEPT 3040,IC15
      CALL CLEAR(LINES)
      TYPE 3116,IC15
      ACCEPT 3113,ICTP15
      CALL CLEAR(LINES)
      TYPE 66,IC15,ICTP15
      ACCEPT 64,SRSP15
      TYPE 3044
      ACCEPT 3040,IC16
      CALL CLEAR(LINES)
      TYPE 3116,IC16
      ACCEPT 3113,ICTP16
      CALL CLEAR(LINES)
      TYPE 66,IC16,ICTP16
      ACCEPT 64,SRSP16
      TYPE 2006
      TYPE 4137,ICCBS(1),ICCBS(2)
 3153 TYPE 2006
C
```

--APPENDIX B--

```
C     TRANSFER INFORMATION TO THE DATA.XXX FILE
C
      WRITE(2,2006)
      WRITE(2,306)
      WRITE(2,4004)
 4004 FORMAT(6X,'DEHP RQFT DATA'///)
      WRITE(2,3046)NAME
 3046 FORMAT(6X,'SUBJECT NAME:',2X,45A1)
      WRITE(2,3047)MASK
 3047 FORMAT(6X,'TYPE OF RESPIRATOR:',2X,45A1)
      WRITE(2,3048)DATE
 3048 FORMAT(6X,'DATE TESTED:',2X,45A1)
      WRITE(2,3049)TIME
 3049 FORMAT(6X,'TIME TESTED:',2X,45A1)
      WRITE(2,2006)
      WRITE(2,54)
   54 FORMAT(6X,'DEHP RQFT CALIBRATION DATA: '//)
      WRITE(2,55)
   55 FORMAT(6X,'CALIBRATION PARAMETER',17X,'SAMPLING RANGE',8X,'AVERAGE
     C')
      WRITE(2,56)
   56 FORMAT(6X,38X,'SWITCH POSITION',7X,'VOLTAGE')
      WRITE(2,57)
   57 FORMAT(6X,39X,'(IN PERCENT)',8X,'(IN VOLTS)'/)
      WRITE(2,58)
   58 FORMAT(6X,'AVERAGE INITIAL VOLTAGE')
      WRITE(2,59)
   59 FORMAT(6X,'ASSOCIATED WITH THE MAXIMUM')
      WRITE(2,30)KCC,VCI
   30 FORMAT(6X,'CHAMBER CHALLENGE CONCENTRATION',12X,F6.2,12X,F6.3/)
      WRITE(2,58)
      WRITE(2,32)
   32 FORMAT(6X,'ASSOCIATED WITH THE BASELINE')
      WRITE(2,33)KBC,VBI
   33 FORMAT(6X,'OF THE DEHP RQFT INSTRUMENT',16X,F6.2,12X,F6.3/)
      WRITE(2,34)
   34 FORMAT(6X,'AVERAGE FINAL VOLTAGE')
      WRITE(2,32)
      WRITE(2,33)KBC,VBF
      WRITE(2,34)
      WRITE(2,59)
      WRITE(2,30)KCC,VCF
      WRITE(2,2006)
      WRITE(2,2006)
      WRITE(2,2006)
      WRITE(2,2006)
      WRITE(2,2006)
      WRITE(2,2006)
      WRITE(2,77)
   77 FORMAT(6X,'EXERCISE INTEGRATOR COUNT INFORMATION:'///)
      WRITE(2,78)
   78 FORMAT(6X,'EXERCISE',26X,'INTEGRATOR',3X,'TIME PERIOD',6X,'SAMPLIN
     CG RANGE')
      WRITE(2,79)
   79 FORMAT(6X,37X,'COUNT',5X,'(IN SECONDS)',5X,'SWITCH POSITION')
      WRITE(2,80)
   80 FORMAT(6X,64X,'(AS A PERCENT)'/)
```

```
      IF(SELECT(7).EQ.'2') GO TO 3154
C
C     TRANSFER THE DEHP RQFT INPUT DATA TO ARRAYS TO FACILITATE
C     PF CALCULATIONS
C
      IC(1)=IC1

      IC(2)=IC2
      IC(3)=IC3
      IC(4)=IC4
      IC(5)=IC5
      IC(6)=IC6
      ICTP(1)=ICTP1
      ICTP(2)=ICTP2
      ICTP(3)=ICTP3
      ICTP(4)=ICTP4
      ICTP(5)=ICTP5
      ICTP(6)=ICTP6
      SRSP(1)=SRSP1
      SRSP(2)=SRSP2
      SRSP(3)=SRSP3
      SRSP(4)=SRSP4
      SRSP(5)=SRSP5
      SRSP(6)=SRSP6
      WRITE(2,3051)IC1,ICTP1,SRSP1
 3051 FORMAT(6X,'NORMAL BREATHING STRAIGHT AHEAD',5X,I6,10X,I2,11X,F6.2)
      WRITE(2,3052)IC2,ICTP2,SRSP2
 3052 FORMAT(6X,'DEEP BREATHING STRAIGHT AHEAD',7X,I6,10X,I2,11X,F6.2)
      WRITE(2,3053)IC3,ICTP3,SRSP3
 3053 FORMAT(6X,'TALKING',29X,I6,10X,I2,11X,F6.2)
      WRITE(2,3054)IC4,ICTP4,SRSP4
 3054 FORMAT(6X,'SIDE-TO-SIDE HEAD MOVEMENTS'/
     C'      (DEEP BREATHING)',20X,I6,10X,I2,11X,F6.2)
      WRITE(2,3055)IC5,ICTP5,SRSP5
 3055 FORMAT(6X,'UP-AND-DOWN HEAD MOVEMENTS'/
     C'      (DEEP BREATHING)',20X,I6,10X,I2,11X,F6.2)
      WRITE(2,3056)IC6,ICTP6,SRSP6
 3056 FORMAT(6X,'FACIAL GRIMACING',20X,I6,10X,I2,11X,F6.2//)
      GO TO 3155
 3154 CONTINUE
      IC(1)=IC1
      IC(2)=IC2
      IC(3)=IC3
      IC(4)=IC4
      IC(5)=IC5
      IC(6)=IC6
      IC(7)=IC7
      IC(8)=IC8
      IC(9)=IC9
      IC(10)=IC10
      IC(11)=IC11
      IC(12)=IC12
      IC(13)=IC13
      IC(14)=IC14
      IC(15)=IC15
      IC(16)=IC16
      ICTP(1)=ICTP1
```

```
      ICTP(2)=ICTP2
      ICTP(3)=ICTP3
      ICTP(4)=ICTP4
      ICTP(5)=ICTP5
      ICTP(6)=ICTP6
      ICTP(7)=ICTP7
      ICTP(8)=ICTP8
      ICTP(9)=ICTP9
      ICTP(10)=ICTP10
      ICTP(11)=ICTP11
      ICTP(12)=ICTP12
      ICTP(13)=ICTP13
      ICTP(14)=ICTP14
      ICTP(15)=ICTP15
      ICTP(16)=ICTP16
      SRSP(1)=SRSP1
      SRSP(2)=SRSP2
      SRSP(3)=SRSP3
      SRSP(4)=SRSP4
      SRSP(5)=SRSP5
      SRSP(6)=SRSP6
      SRSP(7)=SRSP7
      SRSP(8)=SRSP8
      SRSP(9)=SRSP9
      SRSP(10)=SRSP10
      SRSP(11)=SRSP11
      SRSP(12)=SRSP12
      SRSP(13)=SRSP13
      SRSP(14)=SRSP14
      SRSP(15)=SRSP15
      SRSP(16)=SRSP16
      WRITE(2,3051)IC1,ICTP1,SRSP1
      WRITE(2,3156)IC2,ICTP2,SRSP2
3156  FORMAT(6X,'NORMAL BREATHING LEFT',15X,I6,10X,I2,11X,F6.2)
      WRITE(2,3157)IC3,ICTP3,SRSP3
3157  FORMAT(6X,'NORMAL BREATHING RIGHT',14X,I6,10X,I2,11X,F6.2)
      WRITE(2,3158)IC4,ICTP4,SRSP4
3158  FORMAT(6X,'NORMAL BREATHING DOWN',15X,I6,10X,I2,11X,F6.2)
      WRITE(2,3159)IC5,ICTP5,SRSP5
3159  FORMAT(6X,'NORMAL BREATHING UP',17X,I6,10X,I2,11X,F6.2)
      WRITE(2,3052)IC6,ICTP6,SRSP6
      WRITE(2,3160)IC7,ICTP7,SRSP7
3160  FORMAT(6X,'DEEP BREATHING LEFT',17X,I6,10X,I2,11X,F6.2)
      WRITE(2,3161)IC8,ICTP8,SRSP8
3161  FORMAT(6X,'DEEP BREATHING RIGHT',16X,I6,10X,I2,11X,F6.2)
      WRITE(2,3162)IC9,ICTP9,SRSP9
3162  FORMAT(6X,'DEEP BREATHING DOWN',17X,I6,10X,I2,11X,F6.2)
      WRITE(2,3163)IC10,ICTP10,SRSP10
3163  FORMAT(6X,'DEEP BREATHING UP',19X,I6,10X,I2,11X,F6.2)
      WRITE(2,3053)IC11,ICTP11,SRSP11
      WRITE(2,3164)IC12,ICTP12,SRSP12
3164  FORMAT(6X,'FACIAL GRIMACING',20X,I6,10X,I2,11X,F6.2)
      WRITE(2,3165)IC13,ICTP13,SRSP13
3165  FORMAT(6X,'SIDE-TO-SIDE HEAD MOVEMENTS'/
     C'      (NORMAL BREATHING)',18X,I6,10X,I2,11X,F6.2)
      WRITE(2,3166)IC14,ICTP14,SRSP14
3166  FORMAT(6X,'UP-AND-DOWN HEAD MOVEMENTS'/
```

```
     C'      (NORMAL BREATHING)',18X,I6,10X,I2,11X,F6.2)
      WRITE(2,3054)IC15,ICTP15,SRSP15
      WRITE(2,3055)IC16,ICTP16,SRSP16
 3155 CONTINUE
C
C     CALCULATE THE AVERAGE SCATTERED LIGHT PHOTOMETER VOLTAGE
C     OUTPUT FOR EACH EXERCISE
C
      IF(SELECT(7).EQ.'2') GO TO 3167
      DO 3093 I=1,6
      XC(I)=IC(I)
      XC(I)= XC(I)/(1000.0 * ICTP(I))
 3093 CONTINUE
      GO TO 3168
 3167 CONTINUE
      DO 3169 I=1,16
      XC(I)=IC(I)
      XC(I)=XC(I)/(1000.0 * ICTP(I))
 3169 CONTINUE
 3168 CONTINUE
      ENDFILE 2
      REWIND 2
      TYPE 2006
      TYPE 4137,ICCBS(1),ICCBS(2)
      TYPE 2006
C
C     CALCULATE THE INDIVIDUAL EXERCISE PROTECTION FACTORS
C     USING THE RELATIONSHIP :  PF=(CC)/(RL)
C
C     CALCULATION OF: (CC) IS GIVEN BY:
C
C     (CC)=[(VCI+VCF)(KCC)/2 - (VBI+VBF)KBC/2]
C
C
C
C     CALCULATION OF: (RL) IS GIVEN BY:
C
C     (RL)=[(XC(I)*SRSP(I) - (VBI+VBF)(KBC)/2]
C
C
C
C     NOTE:  SINCE THE LEAK MEASURING SENSITIVITY OF THE DEHP RQFT
C            INSTRUMENT IS ONE PART IN TEN TO THE SIXTH, ANY EXERCISE
C            SCALED INTEGRATOR COUNT VALUE YIELDING A PROTECTION
C            FACTOR GREATER THAN 1.0E+06, WILL BE REPORTED AS
C            1.0E+06.  REPORTING A PROTECTION FACTOR GREATER THAN
C            1.0E+06 WOULD BE ERRONEOUS.  ANY EXERCISE SCALED
C            INTEGRATOR COUNT VALUE YIELDING A PROTECTION FACTOR
C            GREATER THAN 1.0E+06 WILL BE REPORTED AS 1.0E+06.
C
C
      TYPE 2006
      TYPE 4137,ICCBS(1),ICCBS(2)
      TYPE 2006
      CC=(((VCI+VCF)*(KCC))/2 - ((VBI+VBF)*(KBC))/2)
      IF(SELECT(7).EQ.'2') GO TO 3173
      DO 3174 I=1,6
```

```
      RL(I)=((XC(I)*SRSP(I))-((VBI+VBF)*(KBC))/2)
      IF(RL(I).LE.0.0) GO TO 9227
      PF(I)=CC/RL(I)
      IF(PF(I).GE.1000000.0) GO TO 9227
      GO TO 3174
 9227 PF(I)=1000000.00
 3174 CONTINUE
      GO TO 9173
 3173 DO 9173 I=1,16
      RL(I)=((XC(I)*SRSP(I))-((VBI+VBF)*(KBC))/2)
      IF(RL(I).LE.0.0) GO TO 4136
      PF(I)=CC/RL(I)
      IF(PF(I).GE.1000000.0) GO TO 4136
      GO TO 9173
 4136 PF(I)=1000000.00
 9173 CONTINUE
C
C     CALCULATE AN OVERALL ARITHMETIC AVERAGE PROTECTION FACTOR FOR
C     ALL EXERCISES
C
      IF(SELECT(7).EQ.'2') GO TO 10
      IDL=6
      IDLP=7
      GO TO 11
   10 CONTINUE
      IDL=16
      IDLP=17
   11 CONTINUE
      KOUNT=0
      PFSUM=0.0
      DO 3060 MT=1,IDL
      KOUNT=KOUNT + 1
      PFSUM=PFSUM + PF(MT)
 3060 CONTINUE
      PF(IDLP)=PFSUM/KOUNT
C
C     CALCULATE AN OVERALL TIME WEIGHTED AVERAGE PROTECTION FACTOR FOR
C     ALL EXERCISES
C
      WPF=0.0
      KKOUNT=0
      PPSUM=0.0
      DO 3194 INT=1,IDL
      KKOUNT=KKOUNT + ICTP(INT)
      PPSUM=PPSUM + (PF(INT)*ICTP(INT))
 3194 CONTINUE
      WPF=PPSUM/KKOUNT
C
C     TRANSFER THE CALCULATED RESULTS TO THE CALCN.MEN FILE
C
      WRITE(3,3061)
 3061 FORMAT(1H1)
      WRITE(3,3062)
 3062 FORMAT(6X,'THE DESCRIPTIVE AND PROTECTION FACTOR CALCULATIONS:'/)
      WRITE(3,9542)
 9542 FORMAT(6X,'NOTE:  ANY PROTECTION FACTOR THAT IS LISTED AS'/
     C'      1.0E+06 HAS BEEN ASSIGNED THIS VALUE BY DEFAULT'/
```

```
     C'      BECAUSE THE SENSITIVITY OF THIS RQFT INSTRUMENT IS'/
     C'      AT MOST ONE PART IN TEN TO THE SIXTH.  THE INTEGRATOR'/
     C'      COUNT VALUE FOR A PARTICULAR EXERCISE IN QUESTION'/
     C'      IS MERELY REPRESENTATIVE OF INTEGRATING THE ELECTRICAL'/
     C'      NOISE AND THE TRUE PROTECTION FACTOR IS INDEED GREATER')
      WRITE(3,9543)
 9543 FORMAT(6X,'THAN 1.0E+06.  ANY EXERCISE SCALED INTEGRATOR'/
     C'      COUNT VALUE YIELDING A PROTECTION FACTOR GREATER'/
     C'      THAN 1.0E+06 WILL BE REPORTED AS 1.0E+06.'//)
      WRITE(3,3176)
 3176 FORMAT(1X,' '//)
      TYPE 3062
      TYPE 2006
      TYPE 9542
      TYPE 9543
      TYPE 2006
      TYPE 4137,ICCBS(1),ICCBS(2)
      TYPE 2006
      WRITE(3,3046)NAME
      WRITE(3,3047)MASK
      WRITE(3,3048)DATE
      WRITE(3,3049)TIME
      WRITE(3,3176)
      TYPE 3046,NAME
      TYPE 3047,MASK
      TYPE 3048,DATE
      TYPE 3049,TIME
      TYPE 2006
      WRITE(3,3063)
 3063 FORMAT(6X,'EXERCISE',29X,'PROTECTION FACTOR'/)
      IF(SELECT(7).EQ.'2') GO TO 3175
      WRITE(3,3064)PF(1)
      TYPE 3064,PF(1)
 3064 FORMAT(6X,'NORMAL BREATHING STRAIGHT AHEAD',6X,1PE12.1)
      WRITE(3,3065)PF(2)
      TYPE 3065,PF(2)
 3065 FORMAT(6X,'DEEP BREATHING STRAIGHT AHEAD',8X,1PE12.1)
      WRITE(3,3066)PF(3)
      TYPE 3066,PF(3)
 3066 FORMAT(6X,'TALKING',30X,1PE12.1)
      WRITE(3,3067)PF(4)
      TYPE 3067,PF(4)
 3067 FORMAT(6X,'SIDE-TO-SIDE HEAD MOVEMENTS'/
     C'       (DEEP BREATHING)',21X,1PE12.1)
      WRITE(3,3068)PF(5)
      TYPE 3068,PF(5)
 3068 FORMAT(6X,'UP-AND-DOWN HEAD MOVEMENTS'/
     C'       (DEEP BREATHING)'21X,1PE12.1)
      WRITE(3,3069)PF(6)
      TYPE 3069,PF(6)
 3069 FORMAT(6X,'FACIAL GRIMACING',21X,1PE12.1)
      TYPE 2006
      WRITE(3,2006)
      WRITE(3,3070)PF(7)
      TYPE 3070,PF(7)
 3070 FORMAT(1HO,5X,'OVERALL ARITHMETIC AVERAGE PROTECTION FACTOR'/
     C'       FOR ALL CATEGORIES OF EXERCISES ACTUALLY PERFORMED = '
```

```
     C,1PE8.1)
      TYPE 2006
      WRITE(3,2006)
      TYPE 3195,WPF
      WRITE(3,3195)WPF
3195 FORMAT(1HO,5X,'OVERALL TIME WEIGHTED AVERAGE PROTECTION FACTOR'/
     C'       FOR ALL CATEGORIES OF EXERCISES ACTUALLY PERFORMED = '
     C,1PE8.1)
      GO TO 3177
3175 CONTINUE
      WRITE(3,3064)PF(1)
      TYPE 3064,PF(1)
      WRITE(3,3179)PF(2)
      TYPE 3179,PF(2)
3179 FORMAT(6X,'NORMAL BREATHING LEFT',16X,1PE12.1)
      WRITE(3,3180)PF(3)
      TYPE 3180,PF(3)
3180 FORMAT(6X,'NORMAL BREATHING RIGHT',15X,1PE12.1)
      WRITE(3,3181)PF(4)
      TYPE 3181,PF(4)
3181 FORMAT(6X,'NORMAL BREATHING DOWN',16X,1PE12.1)
      WRITE(3,3182)PF(5)
      TYPE 3182,PF(5)
3182 FORMAT(6X,'NORMAL BREATHING UP',18X,1PE12.1)
      WRITE(3,3065)PF(6)
      TYPE 3065,PF(6)
      WRITE(3,3184)PF(7)
      TYPE 3184,PF(7)
3184 FORMAT(6X,'DEEP BREATHING LEFT',18X,1PE12.1)
      WRITE(3,3185)PF(8)
      TYPE 3185,PF(8)
3185 FORMAT(6X,'DEEP BREATHING RIGHT',17X,1PE12.1)
      WRITE(3,3186)PF(9)
      TYPE 3186,PF(9)
3186 FORMAT(6X,'DEEP BREATHING DOWN',18X,1PE12.1)
      WRITE(3,3187)PF(10)
      TYPE 3187,PF(10)
3187 FORMAT(6X,'DEEP BREATHING UP',20X,1PE12.1)
      WRITE(3,3066)PF(11)
      TYPE 3066,PF(11)
      WRITE(3,3069)PF(12)
      TYPE 3069,PF(12)
      WRITE(3,3190)PF(13)
      TYPE 3190,PF(13)
3190 FORMAT(6X,'SIDE-TO-SIDE HEAD MOVEMENTS'/
     C'       (NORMAL BREATHING)',19X,1PE12.1)
      WRITE(3,3191)PF(14)
      TYPE 3191,PF(14)
3191 FORMAT(6X,'UP-AND-DOWN HEAD MOVEMENTS'/
     C'       (NORMAL BREATHING)',19X,1PE12.1)
      WRITE(3,3067)PF(15)
      TYPE 3067,PF(15)
      WRITE(3,3068)PF(16)
      WRITE (3,2006)
      TYPE 3068,PF(16)
      TYPE 39
   39 FORMAT(1X,////)
```

```
      WRITE(3,3070)PF(IDLP)
      TYPE 3070,PF(IDLP)
      TYPE 2006
      WRITE(3,3176)
      TYPE 3195,WPF
      WRITE(3,3195)WPF
 3177 CONTINUE
      TYPE 2006
      TYPE 4137,ICCBS(1),ICCBS(2)
      TYPE 2006
C
C     CLOSE THE DATAX.XXX AND CALCX.XXX FILES
C
      CLOSE(UNIT=2)
      CLOSE(UNIT=3)
C
C     THE OPTION OF PROCESSING UP TO NINE SETS OF DEHP RQFT DATA
C     DURING A SINGLE COMPUTER RUN CAN BE ACCOMPLISHED
C
   29 TYPE 14
   14 FORMAT(1X,'DO YOU WISH TO CALCULATE PROTECTION FACTORS FOR'/
     C' A DIFFERENT SUBJECT ?  (ANSWER YES OR NO)  ',2X,$)
      ACCEPT 1002,REP
 1002 FORMAT(1A1)
      IF(REP.EQ.YES)GO TO 6000
      IF(REP.EQ.NO)GO TO 28
      IF(REP.NE.YES.AND.REP.NE.NO) GO TO 29
   28 CONTINUE
      TYPE 2006
      TYPE 4137,ICCBS(1),ICCBS(2)
      TYPE 2006
      TYPE 2006
C
C     NOTIFICATION ON THE CRT SCREEN FOR A SUCCESSFUL
C     COMPUTER RUN IS PROVIDED
C
      TYPE 9599
 9599 FORMAT(1X,12X,'JOB SUCCESSFULLY COMPLETED',////)
      STOP
      END
C
C     SUBROUTINE CLEAR IS USED TO ALLOW THE OPERATOR TO MAKE
C     MORE THAN ONE DATA ENTRY ON THE SAME CRT LINE.  THIS
C     SUBROUTINE ERASES THE LINE ON WHICH THE FIRST DATA
C     ENTRY WAS MADE, AND RETYPES THAT LINE, INCLUDING THE
C     FIRST DATA ENTRY; THIS ALLOWS ADDITIONAL DATA ENTRIES
C     TO BE MADE ON THE SAME LINE BY MERELY DEPRESSING
C     THE CRT RETURN KEY
C
      SUBROUTINE CLEAR(LINES)
      BYTE A(3)
      A(1)=27
      A(2)=65
      A(3)=75
      IF(LINES.EQ.0)LINES=1
      DO 1 I=1,LINES
    1 TYPE 4,A(1),A(2),A(3)
```

--APPENDIX B--

```
      LINES=0
      RETURN
    4 FORMAT(1H+,4A1,$)
      END
```

APPENDIX C:

DATAX.XXX File Contents for Data in Table 3

(Integrator count data for the strip-chart recording in Fig. 5)

--APPENDIX C--

DEHP RQFT DATA

SUBJECT NAME: CAPTAIN EDWARD S. KOLESAR, JR.
TYPE OF RESPIRATOR: USA XM-29; MEDIUM; NO GLASSES
DATE TESTED: 18 JUNE 1981
TIME TESTED: 1127 HRS

DEHP RQFT CALIBRATION DATA:

CALIBRATION PARAMETER	SAMPLING RANGE SWITCH POSITION (AS A PERCENT)	AVERAGE VOLTAGE (IN VOLTS)
AVERAGE INITIAL VOLTAGE ASSOCIATED WITH THE MAXIMUM CHAMBER CHALLENGE CONCENTRATION	100.00	5.820
AVERAGE INITIAL VOLTAGE ASSOCIATED WITH THE BASELINE OF THE DEHP RQFT INSTRUMENT	0.01	0.090
AVERAGE FINAL VOLTAGE ASSOCIATED WITH THE BASELINE OF THE DEHP RQFT INSTRUMENT	0.01	0.050
AVERAGE FINAL VOLTAGE ASSOCIATED WITH THE MAXIMUM CHAMBER CHALLENGE CONCENTRATION	100.00	5.800

EXERCISE INTEGRATOR COUNT INFORMATION:

EXERCISE	INTEGRATOR COUNT	TIME PERIOD (IN SECONDS)	SAMPLING RANGE SWITCH POSITION (AS A PERCENT)
NORMAL BREATHING STRAIGHT AHEAD	131	10	0.01
DEEP BREATHING STRAIGHT AHEAD	3757	10	0.01
TALKING	11871	10	0.01
SIDE-TO-SIDE HEAD MOVEMENTS (DEEP BREATHING)	11074	10	0.01
UP-AND-DOWN HEAD MOVEMENTS (DEEP BREATHING)	8997	10	0.01
FACIAL GRIMACING	6752	10	0.01

AUTHOR'S NOTE: The information in Table 3, in the text, is repeated here to show the format of the computer-generated data file.

APPENDIX D:

CALCX.XXX File Contents for Data in Table 4

(Protection factor computer program calculation for the data in Table 3)

--APPENDIX D--

THE DESCRIPTIVE AND PROTECTION FACTOR CALCULATIONS

NOTE: ANY PROTECTION FACTOR THAT IS LISTED AS 1.0E+06 HAS BEEN ASSIGNED THIS VALUE BY DEFAULT BECAUSE THE SENSITIVITY OF THIS RQFT INSTRUMENT IS AT MOST ONE PART IN TEN TO THE SIXTH. THE INTEGRATOR COUNT VALUE FOR A PARTICULAR EXERCISE IN QUESTION IS MERELY REPRESENTATIVE OF INTEGRATING THE ELECTRICAL NOISE AND THE TRUE PROTECTION FACTOR IS INDEED GREATER THAN 1.0E+06. ANY EXERCISE SCALED INTEGRATOR COUNT VALUE YIELDING A PROTECTION FACTOR GREATER THAN 1.0E+06 WILL BE REPORTED AS 1.0E+06.

SUBJECT NAME: CAPTAIN EDWARD S. KOLESAR, JR.
TYPE OF RESPIRATOR: USA XM-29; MEDIUM; NO GLASSES
DATE TESTED: 18 JUNE 1981
TIME TESTED: 1127 HRS

EXERCISE	PROTECTION FACTOR
NORMAL BREATHING STRAIGHT AHEAD	1.0E+06
DEEP BREATHING STRAIGHT AHEAD	1.9E+05
TALKING	5.2E+04
SIDE-TO-SIDE HEAD MOVEMENTS (DEEP BREATHING)	5.6E+04
UP-AND-DOWN HEAD MOVEMENTS (DEEP BREATHING)	7.0E+04
FACIAL GRIMACING	9.6E+04

OVERALL ARITHMETIC AVERAGE PROTECTION FACTOR
FOR ALL CATEGORIES OF EXERCISES ACTUALLY PERFORMED = 2.4E+05

OVERALL TIME WEIGHTED AVERAGE PROTECTION FACTOR
FOR ALL CATEGORIES OF EXERCISES ACTUALLY PERFORMED = 2.4E+05

AUTHOR'S NOTE: The information in Table 4, in the text, is repeated here to show the format of the computer-generated data file.

APPENDIX E:

User's Guide for the DEHPRQFT.FOR
Computer Program

RESPIRATOR QUANTITATIVE FIT TESTING

INSTRUCTIONS FOR USING THE COMPUTER TERMINALS IN USAFSAM/VN TO PROCESS THE DATA COLLECTED ON THE DEHP ROFT INSTRUMENT

KEY: - COMPUTER GENERATED INFORMATION (CRT SCREEN)

- *Program User Generated Information (entered via the keyboard; information displayed on the CRT screen)*

- Sequential Step Numbers; not displayed on CRT screen

- Comments to help the program user

CRT SCREEN DISPLAY	COMMENT
1) WELCOME TO THE USAFSAM COMPUTER SELECTOR SELECT 70, VAX, OR UNIVAC:_	Computer response after depressing any key on the keyboard.
2) WELCOME TO THE USAFSAM COMPUTER SELECTOR SELECT 70, VAX, OR UNIVAC: VAX_	Type 'VAX'; depress the "RETURN" key on the keyboard twice.
3) USERNAME:_	Computer response.
4) USERNAME: XXXXXX	Type your last name; depress the "RETURN" key on the keyboard.
5) PASSWORD:_	Computer response.
6) PASSWORD: XXXX_	Type your password; depress the "RETURN" key on the keyboard. Password characters are not displayed on the CRT screen.

	CRT SCREEN DISPLAY	COMMENT
7)	. . . (SERIES OF COMPUTER SYSTEM MESSAGES) . . .	No response required on your part.
8)	ENTER TERMINAL "WHITE TAG" SITE ID [1-300]:?_	Last message of group.
9)	ENTER TERMINAL "WHITE TAG" SITE ID [1-300]:? XXX_	Type in terminal site ID number; depress the "RETURN" key on the keyboard.
10)	ARE YOU IN BUILDING: XXX ROOM: XX PHONE: XXXX [Y/N]?_	Computer response.
11)	ARE YOU IN BUILDING: XXX ROOM: XX PHONE: XXXX [Y/N]? Y_	Type 'Y'; depress the "RETURN" key on the keyboard.
12)	ARE YOU ON A VT100 [Y/N]?:_	Computer response.
13)	ARE YOU ON A VT100 [Y/N]?: Y_	Type 'Y'; depress the "RETURN" key on the keyboard.
14)	$_	Computer is ready.
15)	$RUN [KOLESAR]DEHPRQFT_	Type 'RUN [KOLESAR]DEHPRQFT'; depress the "RETURN" key on the keyboard.

CRT SCREEN DISPLAY	COMMENT
16) USER ATTENTION: IN ORDER TO KEEP TRACK OF THE DATA FILES (DATAX.XXX) BEING ANALYZED, IT IS RECOMMENDED THAT THEY BE SEQUENTIALLY NUMBERED. ENTER THE FOLLOWING: 001 FOR THE FIRST DATA FILE; 002 FOR THE SECOND DATA FILE; 003 FOR THE THIRD DATA FILE; ETC. ENTRY=_	Computer response.
17) ENTRY=XXX_	Type a three-digit number; depress the "RETURN" key on the keyboard.
18) USER ATTENTION: IN ORDER TO KEEP TRACK OF THE CALCULATION FILES (CALCX.XXX), IT IS RECOMMENDED THAT THEY BE SEQUENTIALLY NUMBERED. ENTER THE FOLLOWING: 001 FOR THE FIRST CALCULATION FILE; 002 FOR THE SECOND CALCULATION FILE; 003 FOR THE THIRD CALCULATION FILE; ETC. ENTRY=_	Computer response.
19) ENTRY=XXX_	Type a three-digit number; depress the "RETURN" key on the keyboard.
20) DEHP ROFT DATA: SUBJECT NAME:_	Computer response.

CRT SCREEN DISPLAY	COMMENT
21) SUBJECT NAME: XXXXXX_	Type subject's name (up to 45 characters); depress the "RETURN" key on the keyboard.
22) TYPE OF RESPIRATOR:_	Computer response.
23) TYPE OF RESPIRATOR: XXXXXX_	Type the kind of respirator tested (up to 45 characters); depress the "RETURN" key on the keyboard.
24) DATE TESTED:_	Computer response.
25) DATE TESTED: XXXXXX_	Type the date subject was tested (up to 45 characters); depress the "RETURN" key on the keyboard.
26) TIME TESTED:_	Computer response.
27) TIME TESTED: XXXXXX_	Type the time of day subject was tested (for example: 1400 Hrs); depress the "RETURN" key on the keyboard.
28) DEPRESS THE RETURN KEY AFTER ENTERING A SWITCH POSITION AND VOLTAGE	Computer response.

DEHP RQFT CALIBRATION DATA:

CALIBRATION PARAMETER	SAMPLING RANGE SWITCH POSITION (IN PERCENT)	AVERAGE VOLTAGE (IN VOLTS)

CRT SCREEN DISPLAY			COMMENT
29) AVERAGE INITIAL VOLTAGE ASSOCIATED WITH THE MAXIMUM CHAMBER CHAL- LENGE CONCENTRATION	*100.00*	XXX_	Type '100.00'; depress the "RETURN" key on the keyboard. Type the average initial voltage associated with the maximum chamber challenge concentration; depress the "RETURN" key on the keyboard
30) AVERAGE INITIAL VOLTAGE ASSOCIATED WITH THE BASELINE OF THE DEHP RQFT INSTRUMENT	*0.01*	XXX_	Type '0.01'; depress the "RETURN" key on the keyboard. Type the average initial voltage associated with the baseline of the DEHP RQFT instrument; depress the "RETURN" key on the keyboard.
31) AVERAGE FINAL VOLTAGE ASSOCIATED WITH THE BASELINE OF THE DEHP RQFT INSTRUMENT	*0.01*	XXX_	Type '0.01'; depress the "RETURN" key on the keyboard. Type the average final voltage associated with the baseline of the DEHP RQFT instrument; depress the "RETURN" key on the keyboard.
32) AVERAGE FINAL VOLTAGE ASSOCIATED WITH THE MAXIMUM CHAMBER CHAL- LENGE CONCENTRATION	*100.00*	XXX_	Type '100.00'; depress the "RETURN" key on the keyboard. Type the average final voltage associated with the maximum chamber challenge concentration; depress the "RETURN" key on the keyboard.
33) THE USER IS FREE TO SELECT ONE OF TWO GROUPS OF EXERCISE PROTOCOLS			Computer response.
THE [GROUP 1] EXERCISE PROTOCOL CONSISTS OF:			
[1] NORMAL BREATHING STRAIGHT AHEAD [2] DEEP BREATHING STRAIGHT AHEAD			

CRT SCREEN DISPLAY	COMMENT
[3] TALKING [4] SIDE-TO-SIDE HEAD MOVEMENTS (DEEP BREATHING) [5] UP-AND-DOWN HEAD MOVEMENTS (DEEP BREATHING) [6] FACIAL GRIMACING	
34) THE [GROUP 2] EXERCISE PROTOCOL CONSISTS OF: [1] NORMAL BREATHING STRAIGHT AHEAD [2] NORMAL BREATHING LEFT [3] NORMAL BREATHING RIGHT [4] NORMAL BREATHING DOWN [5] NORMAL BREATHING UP [6] DEEP BREATHING STRAIGHT AHEAD [7] DEEP BREATHING LEFT [8] DEEP BREATHING RIGHT [9] DEEP BREATHING DOWN [10] DEEP BREATHING UP [11] TALKING [12] FACIAL GRIMACING [13] SIDE-TO-SIDE HEAD MOVEMENTS (NORMAL BREATHING) [14] UP-AND-DOWN HEAD MOVEMENTS (NORMAL BREATHING) [15] SIDE-TO-SIDE HEAD MOVEMENTS (DEEP BREATHING) [16] UP-AND-DOWN HEAD MOVEMENTS (DEEP BREATHING) ENTRY=_	Computer response.

	CRT SCREEN DISPLAY	COMMENT
35)	ENTRY=*GROUP X*_	Type either 'GROUP 1' or 'GROUP 2'; depress the "RETURN" key on the keyboard.
36)	USER ATTENTION: IF NO EXERCISE COUNT DATA WAS COLLECTED FOR A PARTICULAR EXERCISE, TYPE: 000001. ALSO, FOR EACH EXERCISE INTEGRATOR COUNT DATA ENTRY, SIX DIGITS MUST BE TYPED, THAT IS, IF YOU HAVE A SIX-DIGIT NUMBER, TYPE ALL SIX DIGITS. IF YOU HAVE A FIVE-DIGIT NUMBER, TYPE ONE LEADING ZERO AND THEN THE FIVE DIGITS. IF YOU HAVE A FOUR DIGIT NUMBER, TYPE TWO LEADING ZEROS AND THEN THE FOUR DIGITS, ETC. SEVERAL EXAMPLES FOLLOW AS AN ILLUSTRATION FOR EXAMPLE: *COUNT DATA=743182* TYPED ENTRY=743182 FOR EXAMPLE: COUNT DATA=18726 TYPED ENTRY=018726 FOR EXAMPLE: COUNT DATA=6412 TYPED ENTRY=006412 DEPRESS THE RETURN KEY AFTER ENTERING AN INTEGRATOR COUNT MAGNITUDE, TIME PERIOD, AND SWITCH POSITION EXERCISE INTEGRATOR COUNT INFORMATION: EXERCISE INTEGRATOR COUNT / TIME PERIOD (IN SECONDS) / SAMPLING RANGE SWITCH POSITION (AS A PERCENT)	Computer instructions for entering data. No response required on your part.

CRT SCREEN DISPLAY	COMMENT
37) NORMAL BREATHING STRAIGHT AHEAD XXXXXX XX XXX_	Type the integrator count for this exercise; depress the "RETURN" key on the keyboard. Type the time period; depress the "RETURN" key on the keyboard. Type the sampling range switch position; depress the "RETURN" key on the keyboard.
38) DEEP BREATHING STRAIGHT AHEAD XXXXXX XX XXX_	Type the integrator count for this exercise; depress the "RETURN" key on the keyboard. Type the time period; depress the "RETURN" key on the keyboard. Type the sampling range switch position; depress the "RETURN" key on the keyboard.
	Enter integrator count, time period and sampling range switch position for each exercise; depress the "RETURN" key on the keyboard after each data entry.
39) THE DESCRIPTIVE AND PROTECTION FACTOR CALCULATIONS:	Computer response.
NOTE: ANY PROTECTION FACTOR THAT IS LISTED AS 1.0E+06 HAS BEEN ASSIGNED THIS VALUE BY DEFAULT BECAUSE THE SENSITIVITY OF THIS RQFT INSTRUMENT IS AT MOST ONE PART IN TEN TO THE SIXTH. THE INTEGRATOR COUNT VALUE FOR A PARTICULAR EXERCISE IN QUESTION IS MERELY REPRESENTATIVE OF INTEGRATING THE ELECTRICAL NOISE AND THE TRUE PROTECTION FACTOR IS INDEED LESS THAN 1.0E+06. ANY EXERCISE SCALED INTEGRATOR COUNT VALUE YIELDING A PROTECTION FACTOR GREATER THAN 1.0E+06 WILL BE REPORTED AS 1.0E+06.	

CRT SCREEN DISPLAY	COMMENT
40) ...COMPUTER PROCESSES DATA; ERROR MESSAGES CONCERNING YOUR DATA ENTRIES MAY BE GIVEN; CALCULATION RESULTS WILL BE DISPLAYED. . . .	No action required on your part; please read information. If you want to stop the flow of information on the CRT screen, depress simultaneously the 'CTRL' and 'S' keys on the keyboard. To resume the flow of information on the CRT screen, depress simultaneously the 'CTRL' and 'Q' keys on the keyboard.
41) DO YOU WISH TO CALCULATE PROTECTION FACTORS FOR A DIFFERENT SUBJECT? (ANSWER YES OR NO)	Last of the series of computer messages.
42) DO YOU WISH TO CALCULATE PROTECTION FACTORS FOR A DIFFERENT SUBJECT? (ANSWER YES OR NO) XXX_	Type the word 'YES' or 'NO'; depress the "RETURN" key on the keyboard. If 'YES' is typed, the computer continues with direction number 16). If 'NO' is typed, the computer continues with 43).
43) JOB SUCCESSFULLY COMPLETED *FORTRAN STOP* $_	Computer response.
44) $*PRINT DATAX.XXX*_ JOB N ENTERED ON QUEUE SYS$PRINT $*PRINT CALCX.XXX* JOB N ENTERED ON QUEUE SYS$PRINT $	If you want a computer print out on paper of the results, type 'PRINT DATAX.XXX'; depress the "RETURN" key on the keyboard. Type 'PRINT CALCX.XXX'; depress the "RETURN" key on the keyboard. The first X in DATAX.XXX and CALCX.XXX is 1 for the first data set entered, and increments by 1 each time 'YES' is answered in 42). The three X's in DATAX.XXX and CALCX.XXX refer to the three digits entered in 17) and 19) respectively.

CRT SCREEN DISPLAY	COMMENT
	The computer responds with a job number for each print request.
	Computer printed results can be picked up in the Computer Center, Bldg. 150, approximately 2 hours after you log off the computer terminal.
45) $LOGOUT_	If you are finished using the computer, type "LOGOUT"; depress the "RETURN" key on the keyboard and you will be automatically logged off the computer terminal.

ABBREVIATIONS, ACRONYMS, AND SYMBOLS

B_f	final baseline concentration
B_i	initial baseline concentration
C	concentration
C_a	ambient challenge atmosphere concentration
C_{cor}	average corrected test booth ambient challenge concentration (as a percent)
C_f	final ambient test booth challenge concentration
C_i	initial ambient test booth challenge concentration
cm	centimeter
C_s	sampled leakage concentration
CW	chemical warfare
DB	deep breathing
DEHP	di-2-ethylhexyl phthalate
E or V	voltage or potential difference
FE222	Dynatech Frontier Corporation test booth
FE259H	Dynatech Frontier Corporation di-2-ethylhexyl phthalate respirator quantitative fit test instrument
FG	facial grimacing
I_a	absorbed light intensity
IC	integrator count
i.d.	inside diameter
I_i	incident light intensity
in.	inch
I_{PMT}	photomultiplier tube current signal
I_s	scattered light intensity
I_{si}	stray light circuit current signal
K_{bc}	instrument's sampling range switch position (typically 100.0 percent)

(Cont'd. on facing page)

ABBREVIATIONS, ACRONYMS, AND SYMBOLS (Cont'd.)

K_{cc}	instrument's sampling range switch position (typically 10.0-0.01 percent)
KE	instrument's sampling range switch position used during the exercise measurement time period (typically 10.0-0.01 percent)
LASL	Los Alamos Scientific Laboratory
LED	light-emitting-diode
m	meter
m^3	cubic meter
MBU-13/P	United States Air Force aircrew chemical-biological oxygen mask
mg	milligrams
min	minute
MMAD	mass median aerodynamic diameter
mV	millivolt
NaCl	sodium chloride
NB	normal breathing
NRL	Naval Research Laboratory
PF	protection factor
$\overline{PF}$	average protection factor
PF_x	protection factor for a particular exercise x, for x = {NB, DB, TH, UD, T, or FG}
PMT	photomultiplier tube
psig	pounds per square inch gauge
R	resistance
$RE_{(cor, x)}$	average corrected respirator sampled leakage (as a percent) for a particular exercise x, for x = {NB, DB, TH, UD, T, or FG}
RE_x	average respirator sampled leakage determined from a strip-chart recording for a particular exercise x, for x = {NB, DB, TH, UD, T, or FG}
RQFT	respirator quantitative fit test
sec	second
T	talking

(Cont'd. on next page)

TH	turning head side-to-side with deep breathing
UD	moving head up-and-down with deep breathing
USAFSAM	United States Air Force School of Aerospace Medicine
$\overline{V}$	average voltage
V/F	voltage-to-frequency
VB_f	average voltage response associated with the final baseline concentration (corresponds to B_f)
VB_i	average voltage response associated with the initial baseline concentration (corresponds to B_i)
VC_f	average final voltage response associated with the test booth challenge concentration (corresponds to C_f)
VC_i	average initial voltage response associated with the test booth challenge concentration (corresponds to C_i)
VN	Crew Technology Division
VNL	Crew Environments Branch
VRE_x	average voltage response associated with the average respirator sampled leakage determined from the integration count for a particular exercise x, for x = {NB, DB, TH, UD, T, or FG}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